Towards an Ontology and Canvas for Strongly Sustainable Business Models: A Systemic Design Science Exploration

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Abstract

An ontology describing the constructs and their inter-relationships for business models has recently been built and evaluated: the Business Model Ontology (BMO). This ontology has been used to conceptually power a popular practitioner visual design tool: the Business Model Canvas (BMC).

However, implicitly these works assume that designers of business models all have a singular normative goal: the creation of businesses that are financially profitable. These works perpetuate beliefs and businesses that do not create outcomes aligned with current natural and social science knowledge about long term individual human, societal and ecological flourishing, i.e. outcomes are not strongly sustainable. This limits the applicability and utility of these works.

This exploratory research starts to overcome these limitations: creating knowledge of what is required of businesses for strongly sustainable outcomes to emerge and helping business model designers efficiently create high quality (reliable, consistent, effective) strongly sustainable business models.

Based on criticism and review, this research project extends the BMO artefact to enable the description all the constructs and their inter-relationships related to a strongly sustainable business model. This results in the Strongly Sustainable Business Model Ontology (SSBMO). To help evaluate the SSBMO a practitioner visual design tool is also developed: the Strongly Sustainable Business Model Canvas (SSBMC).

Ontological engineering (from Artificial Intelligence), Design Science and Systems Thinking methodological approaches were combined in a novel manner to create the Systemic Design Science approach used to build and evaluate the SSBMO. Comparative analysis, interviews and case study techniques were used to evaluate the utility of the designed artefacts.

Formal 3rd party evaluation with 7 experts and 2 case study companies resulted in validation of the overall approaches used and the utility of the SSBMO. A number of opportunities for improvement, as well as areas for future work, are identified.

This thesis includes a number of supplementary graphics included in separate (electronic) files. See “List of Supplementary Materials” below for details.

Keywords

Business Model; Strong Sustainability; Resilience; Flourishing; Socially Desirable Value; Corporate Social Responsibility; Organizational Design; Ecological Design; Innovation; Strategy; Information System; Design Science; Systems Thinking; Ontology; Tool;.Micro-Ecological Economics, Environmental Studies.

Dedication

To my wife and soul-mate, Lyanne:

On our journey, to flourish together

This is done, ***and*** *the journey continues!*

To my parents, Christopher and Janet Upward

For showing me:

- *That this life is al we hav;*
- *That rationl thot is our gretst gift against ignrnce and fear;*
- *And that we ar al bound togethr in mutul respect and lov*[1].

To all those who choose to make their goal

the flourishing of humanity and all other life forever

[1] Orthography is "Cut Spelling", a system designed by my father, an academic linguist, for the rationalizing of English Spelling primarily through the omission of redundant (unsounded) letters: thus assisting learners, readers and writers http://www.spellingsociety.org/aboutsss/leaflets/cutspel1.php. These words from the text of his 2002 funeral program, written by my mother.

Acknowledgements & Thanks

I want to acknowledge the pioneers of the Faculty of Environmental Studies at York University. Over 40 years ago these visionaries realized that critical to the flourishing of humanity and other life on planet Earth was a space for inter- and trans-disciplinary research. They realized this research is required to tackle our toughest real-world problems, and that such research is not only possible, but must become normal and expected. Without their leadership there would have been no place in academia to attempt to rigorously undertake this research.

I would also like to acknowledge and thank the following for their generous support, encouragement, criticism, feedback and help:

- My supervisory committee: Dr. David Johnston, Dr. Rod MacRae, Dr. Martin Bunch as well as my advisor Dr. Ellie Perkins.
- The additional member of my examination committee: Dr. Henry Kim[2].
- My co-founders and other members of the Strongly Sustainable Business Model Group at the Ontario College of Art and Design University's Strategic Innovation Lab: Dr. Nabil Harfoush, Dr. Peter Jones, Prof. Jeremy Bowes, and Dr. Bob Willard, Mr. Stephen Davies, Mr. Stephen Dobson.
- The nine key participants in the evaluation activities, whose identity is protected based on the informed consent process, and the many dozens of others who generously gave their time to help evaluate the utility of the Strongly Sustainable Business Model Ontology and Canvas 2011-2013.
- Ms. Samira Drapeau for her invaluable assistance obtaining the copyright clearances.
- Everyone else, too numerous to mention, who offered their support and encouragement – thank-you!

Finally, I want to thank, with all my love, my wife Lyanne for her unwavering support and belief in me, this work and the plan to bring it to the world.

[2] Dr. Yves Pigneur, Dr. Alex Osterwalder's PhD supervisor, was also invited and was keen to be involved, but other commitments intervened. Thanks are given for the time he took to consider our request to join my examination committee.

Copyright Declaration

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List of Publications

The following edited extracts of this thesis have been previously published, or are planned to be published:

- As blog posts for the Ontario College of Art and Design University's Strategic Innovation Lab blog:
  - Strongly Sustainable Business Models: A Personal Perspective on a New Field of Practice and Research (from Chapters 1-3).
  - Towards a Definition of Organizational Strong Sustainability - A Review of the Literature (from Chapters 3 and 4)
  - Towards Business Design Principles for Strongly Sustainable Organizations (from Chapters 4 and 7).
- As an article, submitted for a special issue of Business and Society "Corporate Sustainability – Off to Pastures New or Back to the Roots? Exploring New Perspectives, Theories and Research Methods in Corporate Sustainability Research" entitled Design Science to the Rescue? Knowledge Production for the Sustainable Organization (from Chapter 3).
- An article, in development, with PhD student, Stephen Dobson, regarding the definition of Organizational Strong Sustainability.
- As an article, in development, with Dr. Rod MacRae and Dr. Peter Jones, regarding methods and techniques for Evaluation in Systemic Design Science research (Chapter 6).

Finally sections of Chapters 1-6 were quoted in a recent Social Science and Humanities Research Council (SSHRC) emerging scholar trans-disciplinary grant application "Organizational System Design for Strongly Sustainable Business Models" in the priority research areas of Innovation, Leadership & Prosperity and Canadian Environmental Issues.

List of Supplementary Materials

The following items have not been printed (due to colour / size) but are provided on CD ROM (at back of printed thesis) / separate PDF files (on-line).

The conceptual and diagrammatic formalism used in these diagrams is described in Chapter 5. Section 5.2.6 introduces the conceptual formalism, and sections 5.4.4 thru 5.4.8 describe the diagrammatic formalism. SM1 and SM2 are described in the cited work. SM3 thru SM5 are described in Chapter 7. SM6 and SM7 are described in Chapter 8.

SM1. Summary visual representation of the Business Model Ontology, 8.5”x11” (Osterwalder, 2004b, Slide 7; Osterwalder, 2004a, p. 44).

SM2. Detailed, formal diagrammatic representation of the Business Model Ontology, showing all entities, details of specific entity relationships, and all attributes for each specific entity 8.5”x14” (Assembled from text, tables and figures Osterwalder, 2004a, pp.42-102).

SM3. Summary visual representation of the Strongly Sustainable Business Model Ontology, 8.5”x11” (v1.031). (Chapter 7).

SM4. Detailed, formal diagrammatic representation of the Strongly Sustainable Business Model Ontology (v1.031). (Chapter 7).

SM4a: 11”x17” diagram showing all entities and details of specific entity relationships.

SM4b: 11”x17” diagram that adds details of all attributes for each specific entity.

SM5. Diagrammatic representation of the Strongly Sustainable Business Model Canvas. (Chapter 7).

SM5a: 11”x17” overview diagram (v1.03).

SM5b: 8.5”x11” blank canvas with help comments (v1.031).

SM5c: 48”x”58” blank canvas (v1.032).

SM6. An example instantiation of the Strongly Sustainable Business Model Ontology (v1.022) showing the business model of The Timberland Company (Chapter 8).

SM6a: 44”x44” Detailed tabular form using spreadsheet tables.

SM6b: 8.5”x11” Presentation format summary.

SM7. An example instantiation of the Strongly Sustainable Business Model Ontology showing the business model of The Timberland Company expressed using post-it notes on the Strongly Sustainable Business Model Canvas (v1.03) (24”x20”). (Chapter 8).

Abbreviations and Glossary

To improve the efficiency for the reader a consistent set of abbreviations is used, see Part V.

Given the wide range of backgrounds of potential readers a short annotated glossary is provided in Part V.

Conventions

In this text:

Paragraphs in italics are a quotation (with citation).

"Sentences in double quotation marks" are a quotation (with citation).

'Words' in single quotation marks have commonly understood sources for their meanings.

Chapter 3, 3.5, 3.5.1, 3.5.1.3, indicate a reference within this document to a chapter, section, sub-section and minor sectors within a chapter, in this example, Chapter 3.

Table 4-1, Figure 4-1, indicate a reference within this document to a table or figure within a chapter, in this example, Chapter 4.

3.5.1.3 Benefits of Ontologies indicate a reference to a heading within the minor section 3.5.1.3 with the title "Benefits of Ontologies".

Footnotes are numbered starting at 1 ***within*** each chapter.

> Words in a green double lined box are research questions or definitions concerning the research purpose, process or output.

> Words in a blue triple lined box are questions posed by the researcher to guide the reader through the description of the research process and its output.

To best position tables and figures relative to the text which describes them, and to avoid tables or table rows being split over page boundaries, blank space may appear:

- Prior to the start of tables or figures
- Within a table

Part I: Point of Departure[1]

We don't have to save the world. The world is big enough to look after itself. What we have to be concerned about is whether or not the world we live in will be capable of sustaining us in it — Douglas Adams

Civilization exists by geological consent, subject to change without notice
— Will Durant

The one unchangeable certainty is that nothing is certain or unchangeable
—John F. Kennedy

This part describes the context for, origins and goals of, as well as the overall approach to, undertaking this research (Chapters 1 and 2).

[1] When heading on a "journey" "towards" something or some place, as context, one needs to understand "where" one is leaving from.

Chapter One: Context and Motivation

I can't understand why people are frightened of new ideas; I'm frightened of the old ones — John Cage

1.1 Researcher Background

My family has a history of challenging the status quo through three generations of social, artistic and academic activism and advocacy. My original disciplinary training was in computer science, computer systems engineering and information systems – all fields involving the creation of artefacts (the hardware and software of digital information systems) through the processes of abstraction, and all with the intention of creating improved futures.

This background led me to a world-view where imagining such improved futures is the norm. It was expressed in my passion to understand how changing (i.e. designing) how things get done (i.e. process) can realize those different futures. I have followed this passion in my 25 year career as a management consultant and university instructor. My focus was helping people realise improved futures via the (re)design their organizations' business processes and associated digital information systems. These experiences led me to believe that business process, and their context (business models), are a critical, albeit often ignored lens that can be used by organizations to successfully innovate to realize outcomes desired by their stakeholders.

In 2001 I was asked to design a 4th year undergraduate university course "business process analysis and design" for the Ryerson University Faculty of Business School of Information Technology Management. This required a search for relevant theories and practices related to design and business process (Upward, 2002). From this search, it appeared that applying design thinking to business process had received less attention than the application of design thinking to other domains (e.g. architecture, landscape, products, or software) (Baratta, 2011; Hammer, 1998b; originally supported by Hammer, 1998a; subsequently reinforced by Martin, 2009).

At the same time, I was realizing the clear and compelling urgency and breadth of the changes we need to make to enable sustainable human flourishing on planet Earth. I began to see a strong connection between the power of the business model and design thinking lenses to help organizations make the significant changes needed to meet the objective of sustainable flourishing (work by one of the founders of the field of industrial ecology help these ideas coalesce Ehrenfeld, 2008; Hopkins, 2009).

This led me to ask:

> What design patterns and design processes would enable the outcomes of business models, when implemented by organizations, to include sustainable flourishing on this planet?

I and others realized research that provides theoretical and practical answers to this question would help fellow researchers and practitioners[2] as they strive to create sustainable organizations (As but two examples Hutchins, 2012b; Osgood, 2009).

1.2 Research Context

As a result of this broad motivation the focus of this research is business models: colloquially, descriptions of the design of human organizations[3].

Human systems, of which our organizations are an example, have multiple complex reflexive relationships with their contexts (Trist, 1992). Thus, before describing the goals and method of this research (introduced in Chapter 2 and described in Chapters 3 thru 6) and defining the key concepts (Chapter 4), it is critical to begin by stating the researcher's understanding of context for their research (Morley, 1997, revised 2010).

Context is challenging to describe as it is not static: "the only constant is change" (Heraclitus). Hence I have chosen to describe the context for this research not as a

[2] e.g. managers in firms, entrepreneurs and innovators (social, environmental, economic), business model designers, business architects, management consultants, venture capitalists, business strategists, etc.
[3] The term "business model" will be defined in chapter 3 and explored in detail in chapter 4. Until it is formally defined the terms "business design" and "business model" are used inter-changeably.

description of what is (which will change), but rather to describe it as the set of relevant changes in human affairs that are underway as this research was being conceived and conducted, and that it appears will remain underway during its subsequent application in the world.

1.2.1 The Global Problématique

But for the purposes of story telling a beginning is necessary, and, however arbitrary, this requires a description of what is. As a beginning for the story of the context of this research, I have chosen one of the earliest and (still) one of the most comprehensive descriptions of the state of human affairs. Written in 1970, consciously using a systems thinking approach to its analysis, it was one of the submissions to the first meeting of the still influential Club of Rome. Ozbekhan's "The Predicament of Mankind, Quest for Structured Responses to Growing World-Wide Complexities and Uncertainties: A Proposal" (Ozbekhan, 1970) describes what he refers to as the "global problématique" facing humanity. He identifies 49 "continuous critical problems" facing humanity which he strongly differentiates from problems tractable by analytical techniques, stating:

> *"We find it virtually impossible to view [the continuous critical problems] as problems that exist in isolation – or, as problems capable of being solved in their own terms. For even the most cursory examination will at least reveal the more obvious (though not necessarily the most important) links between problems. [… An] unfortunate consequence of the preference we display toward orthodox [analytical] problem-solving is the misapplication of effort and energy. Thus many agronomists devote a great deal of ingenuity toward increasing the yield per acre of our crops without seeming to realize that the particular solution called "agriculture" may possibly no longer represent the single, feasible resolution of the problems clustered under words such as "hunger" or "malnutrition" when the latter are considered in their world-wide dimensions. It seems reasonable, therefore, to postulate that the fragmentation of reality into closed and well-bounded problems creates a new problem whose solution is clearly beyond the scope of the concepts we customarily*

> *employ. It is this generalized meta-problem (or meta-system of problems) which we have called and shall continue to call the "problématique " that inheres in our situation.* (Ozbekhan, 1970, pp.12-13)

Subsequent authors have grouped the 49 continuous critical problems into 10 clusters, which provide a sense of the state of human affairs which Ozbekhan perceived and communicated to the members of the Club of Rome at their first meeting:

1. *Population growth / distribution*
2. *Poverty, Lags and Gaps*
3. *Warfare*
4. *Urbanization*
5. *Education*
6. *Institutional Arrangements*
7. *Prejudices*
8. *Unknowns*
9. *Environment*
10. *Value-base*

(Flanagan, Bausch, & Institute for 21st Century Agoras, 2011, pp.23-24)

It is within this "global problématique" that this research is situated. It's ultimate aim is to help managers of organizations to avoid worsening, and at best state to help to resolve the continuous critical problems.

1.2.2 Themes of Change in Human Affairs

Having established a starting point, with a broad brush, I will now paint the over arching themes of change in human affairs as the narrative elements of the context of this research.

As each of these themes impinges on detailed elements of the research design and research outputs they will be explored in detail in subsequent chapters. For now consider this, as with all good contexts, as setting the scene, for the subsequent unfolding.

> *I believe we are leaving one cultural and technological age [the machine age] and are entering another [the systems age], and that we are in an early stage of changes in our conception of the world and in our way of thinking about it.*
> (Ackoff, 1974)

In this work Ackoff argues that at present we are just starting to under-go a shift in human understanding as significant and fundamental as the one initiated by the Renaissance, marking the end of the middle-ages and the start of the machine age (and its industrial revolution). Ackoff refers to this new age as the "systems age".

Examples of this shift relevant to human organizations include the following[4]:

- From understanding society as independent of the biophysical systems of our planet, to a holonic understanding of the utter ultimate dependence of society on these systems (Catton & Dunlap, 1978; Hawken, 2010, first published 1993; Willard, 2012, p.8).
- From understanding the economic systems as separate from the social and biophysical systems, to a holonic understanding of the nested relationship of the biophysical, social and economic systems (summarized in Victor, 2008, pp.23-38).
- From understanding organizations as mechanism or single minds (organization as brain), to understanding them as ideal seeking (purposeful) systems, to understanding them as ideal seeking multi-minded purposeful systems (summarized in Gharajedaghi, 2011, pp.9-24).
- From planning with no ability to foresee the unintended consequences, to starting to have the knowledge and methods (such as backcasting) to be able to attempt avoid the unintended in "wicked" and "messy" problem domains (summarized in Alpaslan, 2011; Holmberg & Robèrt, 2000; Robinson, 2003).
- From understanding simple sustainable development to understanding paradoxical strong sustainability (explored in depth in Allen, 2003; Neumayer, 2010).

[4] Citations should be considered as pointers to works which introduce and summarize relevant scholarship.

- From not knowing if our plans, once implemented, would create more or less sustainable outcomes, to starting to have the knowledge to be able to attempt to pro-actively / reliably create less unsustainable and perhaps sustainable outcomes (as examples of this new knowledge Eriksson & Robèrt, 1991; Ostrom, 2008; Rockström & et. al., 2009).
- As we transition from natural science/engineering as the dominant lens for understanding the world to a range of lenses including the ecological/managerial (introduced in Allen, 2003)
- As we transition from purely intuitive approaches to problem solving to problem solving approaches which are consciously designed (Ackoff, 1981a; Broman, Holmberg, & Robèrt, 2000; Robinson, 1982; Simon, 1996, first published 1969).
- As we transition from legal and regulatory frameworks for organizations based on an organizational purpose of maximizing direct, short term, monetary flows to legal and regulatory frameworks which explicitly recognize the relationships between our organizations, the economy, society and the environment (Chung, Convery, Golden, & Hewitt, 2010; Richardson, 2010).

As with the Renaissance, the impact of these changes in our conceptual understanding of the world, our place within it and relationships to it, are also starting to change our values and hence what we choose to value[5].

One area where our world-view (particularly in the Global North) is changing relates to the perceived relative importance of the nested economic, social and biophysical systems. To summarize, it appears that as our understanding of our utter dependence upon our finite planet grows, we are starting a transition from a value system which gives primacy to the economic where the social and biophysical are considered as the other, to a single integrated view where the economic is embedded, enabled by and dependent on the social and biophysical (See these works for views of the emerging societal and personal values and

[5] Changes in what is valued and the values of individuals or groups of are called a value-systems or a world-views in this thesis.

what we should value Doppelt, 2012; Handy, 2008; Hawken, 2010, first published 1993; McDonough & Braungart, 2002; Porritt, 2007).

Applying these author’s ideas on the emerging world-views to human organizations, particularly for-profit businesses, suggests that in order to retain their social (and perhaps later legal) license to operate businesses will need to shift from:

- From creating (monetary) profit for the financial investors in organizations to holistically creating satisfactory value for all stakeholder’s of our organizations.
- From business design that focuses on customer/shareholder outcome to business design focused on stakeholder outcome.
- From business design which focuses on maximizing local efficiencies to design that focuses on effectiveness of cradle-to-cradle outcomes.

1.3 Research Motivation

1.3.1 Intrinsic

This understanding of the changes underway in the world, coupled with my own background, created within me the motivation to undertake this research, starting with a positive outlook on humanities aspirations and challenges. It is an exciting time to be alive – worrying too for sure – but, at the risk of being called naive, in this research I choose to focus on the positive!

Assume hope all you who enter here – Attributed to Vaclav Havel

Collectively we now know more than any group of humans ever before, and we have an unparalleled set of methods for generating and validating new knowledge. I believe we are the first generation of humanity who has enough knowledge that we can realistically begin to proactively understand which of our choices are likely to lead to outcomes that can be sustained. This is the positive basis from which I humbly undertake this research.

1.3.2 Extrinsic

Exploring this research's context revealed a significant number of more sustainable, or at least less unsustainable, business designs being implemented by organizations and studied by academia. Labels have started appearing in the popular and academic press to describe commons patterns in these designs, e.g.: servicisation, dematerialization, localist, social-entrepreneurship, impact investing, Benefit Corporation, etc.

However this exploration also identified a gap in knowledge (explored in depth in Chapter 4) the apparent lack of:

1. A micro-economic, social and environmental definition of sustainability (i.e. a definition applicable to human organizations) based on the latest natural, social and formal science literature, along with business design principles, metrics and measures.
2. A conceptualization of micro-economic, social and environmental sustainability within the existing business model literature.
3. A catalogue of patterns of successful sustainable business model designs, described using a taxonomy based on a model of sustainable business.

This gap means there are significant limitations to the advice that can be provided to managers on what a sustainable firm looks like, how to design one, and how to measure whether a firm is sustainable[6, 7].

Having identified a gap, the next task was to identify research outputs which could contribute to its closing. To do this I turned to my computer science and management information systems disciplinary training for inspiration.

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[6] Until these terms are defined the term sustainable will be used, rather than the "strong sustainability" in the research title. See 2.7 for the rationale.

[7] The role in which I imagine providing this type of advice is as a Business Architect - the title I have used for myself for the past 15 years. See Annotated Glossary for more details.

This disciplinary perspective suggested a contribution to closing the gap could be achieved by the creation of a:

- Model which could be used to describe sustainable business designs (i.e. a meta-model)
- Shared understand of such model and its practical implications.

As a result, and at its most broad perspective, this research is a contribution to the process of bringing a world into existence where managers can more easily design sustainable business models based on the latest natural and social science knowledge of sustainability. In turn this will help organizations to enable sustainability outcomes, contributing to the resolution of the Global Problématique.

Today the business models of organizations that claim they are attempting to increase their sustainability do not systemically apply the latest natural and social science knowledge of what constitutes sustainability (Broman et al., 2000; Eriksson & Robèrt, 1991). Further evidence grows daily of the urgent need to improve the sustainability of our organizations to avoid the worst effects of climate change and other anthropomorphic impacts. With these realities in mind the identified gap is not a trivial problem; further solutions to this gap are likely to be applicable to a large audience: anyone designing businesses.

The work to change world-views, let alone the conceptual and practical work to improve the sustainability of our organizations is huge and urgent: it requires the leadership and efforts of people in all organizations world-wide (Hill, 2006).

Hence the motivation to undertake this research is that its outputs may be helpful to managers attempting to improve their organizations, and hence humanities, sustainability: the single most important moral imperative of our time. This research is important, worthwhile and perhaps may make a difference.

Chapter Two: Research Goals and Approach

If we do not change our direction, we are likely to end up where we are headed — Chinese Proverb

2.1 Rationale and Relevance

Until the ground breaking work of Alexander Osterwalder (Osterwalder, 2004a), and its subsequently commercialization (Osterwalder & Pigneur, 2009; Osterwalder, 2010, 2011; Osterwalder & Smith, 2012; A. Smith, Osterwalder, Business Model Foundry GmbH, & Hortis - Le Studio, 2011) business model designers did not have any tools to help them efficiently design high quality (reliable, consistent and effective) monetarily profitable business models, i.e. business models that explicitly use our best available knowledge to reliably increase the likelihood of profitable outcomes.

Osterwalder has noted that prior to his tool, "in entrepreneurship [unlike in car design] we [relied] on real-life crash tests [through the creation of new firms with new business models] which leads to costly failures" (Osterwalder, 2011,slide 19 [minute 3.00-3.30]). This means the likelihood of those businesses becoming monetarily profitable is low. Hence, the risk of firm failure is high for business model designers and the stakeholders of the firms instantiating those business models (Organization for Economic Co-operation and Development (OECD), 2001, p.14 Fig. VIII.5).

Adding to the urgency of the overall situation is the need for firms to survive economically: continuously improve their business models faster and more effectively than their competitors. Competition inevitably results in a lessening of the viability of firms' business models over-time. Competition in a market segment has been likened to all the participating firms walking up a down escalator. A firm that chooses not to innovate it's products and services (and the encompassing business model) is not staying still; it is going backwards relative to the market, whose other members are innovating. Hence innovating is a minimum requirement for remaining competitive: to gain or retain a competitive advantage requires innovating faster and more effectively than others (Moore, 2002).

That businesses need to systemically innovate their business models, and that tools can help business model designers prepare high quality business models efficiently, has been identified by a number of authors based on a range of empirical research (Daum, 2007; von Scheel, Rosenberg, & von Rosing, 2011).

The systematic innovation of business models is critical to each and every firm's initial and on-going success. But, as Osterwalder observes, the historic lack of tools to help business model designers to create and evolve business models results in business design processes that are inefficient, unreliable, inconsistent and ineffective. Specifically, without tools the consistent and explicit use of existing knowledge to design better business models, and the subsequent communication of the resultant design, is difficult. The lack of tools, Osterwalder asserts, is a key driver for the failure rate of new and existing businesses and the generally inefficient use of investment capital. In the talk mentioned above Osterwalder illustrates this point with a pile of burning dollar bills (Osterwalder, 2011,slide 19 [minute 3.00-3.30]).

Paraphrasing the value Osterwalder placed on his own work: 'I'm going to help you (practitioners) be more effective at designing a high quality model of your business that increases the likelihood it will make money'. This was an improvement over what had existed up to that time, which were not comprehensive, did not explicitly use the available theoretical knowledge nor were formally structured.

However, this analysis (explored in depth in Chapter 4) identified a weakness which limits the utility of Osterwalder's work for managers wishing to improve, or at least avoid worsening, the Global Problématique. This limitation is due to an overriding but implicit normative assumption which is shared with a significant majority of the business model literature: It is assumed that all business model designers agree with Milton Friedman:

> *There is one and only one social responsibility of business – to use its resources and engage in activities designed to increase profits so long as it stays within the rules of the game, which is to say, engages in open and free competition without deception or fraud.* (Friedman, 1962, p.133)

As a result of this assumption the current business model literature and the practitioner tools derived from it do not include the key learnings about sustainability which have arisen from our journey from the "machine" to the "systems age" (1.2.2 above): a comprehensive understanding of business models that incorporates our current understanding of sustainability does not exist.

In this thesis the world-views that lead to agreement with:

- Milton Friedman, that monetary profit is the sole legitimate objective of firms, are labelled as "profit-first"[8].
- The idea that firms need to integrate the achievement of monetary, social and environmental benefits, are labelled "sustainable".

Existing business model design tools are implicitly based on the profit first world view. Managers wishing to design businesses that, to some degree, integrate the achievement of monetary, social and environmental benefits are required to rely on their individual knowledge and experience. Managers will use their knowledge to design businesses whose outcomes are, in their opinion and experience, less unsustainable or possibly sustainable, by making choices based on their existing values and assumptions.

For example, a forthcoming review of the operations management and entrepreneurship literature failed to find scholarly works that supports environmental sustainability in the early stages of entrepreneurship (i.e. the discovery of a workable business model) (Joglekar & Lévesque, Forthcoming - Special Issue on Technology Commercialization, Entrepreneurship and Growth Driven Operations).

This means the latest scientific knowledge and practitioner experience of what constitutes sustainability for organizations is at worse ignored and at best inconsistently applied. In turn, as many authors have noted, this makes achievement of sustainability outcomes by

[8] Having introduced the idea of "Profit First" here, details of this idea are explored in increasing detail in chapters 3 and 4.

organizations unlikely (unreliable) and difficult (inefficient) (Doig, 2003; Ehrenfeld, 2008; McDonough & Braungart, 2002).

Business model designers who believe that businesses have a role to play in avoiding worsening or perhaps improving the Global Problématique do not have a tool that integrates the latest natural and social science knowledge about the continuous critical problems[9]. Further, due to the different assumed world-view, it is difficult to efficiently use existing business model tools to help design high quality (reliable, consistent, and effective) sustainable business models – i.e. business models that use our best available knowledge to increase the likelihood of sustainable outcomes emerging.

A sustainable business model design tool could be valuable to managers and other organizational stakeholders seeking to avoid worsening or improving the Global Problématique in a number of contexts:

- New firms could increase likelihood of sustainability outcomes from day 1 (or at least enable a comprehensive understanding of gaps).
- Existing firms could understand gaps faster and more comprehensively, hence speeding action towards sustainability.
- Eco-business / eco-industrial zones could accelerate achievement of zone objectives.
- Organizations promoting principles, frameworks and standards for understanding and measuring business sustainability could make this knowledge easier for managers to use.
- Policy makers could better understand impact of policy at the firm level, and then design policies to encourage sustainability.
- Management advisors and impact investors could provide advice on improving sustainability outcomes (strategy, planning, and execution).

[9] A recent white paper published by an association of practicing business model designers, the Business Architecture Guild (http://www.BusinessArchitectureGuild.org), includes a discussion of using the techniques of business design to develop and implement organizational sustainability strategies. There is no reference to tools that could assist (Melaragno, 2010).

Building on Osterwalder and to summarize: the value I believe this research could have for managers is its usefulness: 'I'm going to help you be more effective at designing a high quality model of your business that increases the likelihood that it will be environmentally, socially and monetarily sustainable'. This is an improvement over what has existed up to this time , which has not included attempts of formally structuring conceptions of sustainability based on the applicable science within business models.

Using the example of a firm which catches wild fish[10]. I want to provide the managers in this firm a model that would allow them to describe how their firm could/does "fish sustainably" (their business model). I am **not** intending to provide: a business model design or patterns that describe a sustainable fishing firm; a process to create a sustainable business model of a fishing firm; a guarantee that using my model will result in a sustainable business model design or fishing firm; nor sustainable fish to eat!

2.2 Research Question and Goal

From this background, context and motivation, and based on the above rationale, the overall research question is:

> **RQ**: Is it possible to design a model of a business that can be usefully employed to describe a firm's environmentally, socially and economically sustainable business design?

Following other researchers in the field of business and modelling (3.5.1.3) such a model should be capable of describing the current or future state of any firm – irrespective of size, industrial sector or alignment with known sustainability best practices. Hence such a model can be used as part of innovative methodological approaches believed to be particularly relevant for creating sustainability strategies, such as backcasting (Dreborg, 1996; Holmberg & Robèrt, 2000; Robinson, 1990; Robinson, 2003; Robinson, 2003; Upward, 2011).

[10] Based on the saying "give someone a fish and they will eat for a day; teach someone to fish and they will feed themselves and their family for a lifetime", which of course ignores what happens if everyone does this with modern industrial fishing methods!

The goal of answering the research question, and hence the research objective and business problem this research is looking to help managers solve, is how to

RO: Increase the quality (reliability, consistency, effectiveness) of sustainable business models and the efficiency of their production.

- In answering this research question an overall research objective is that:

RO0: The research design will be of the highest quality possible: minimizing bias by maximizing rigour, hence maximizing the legitimacy of the research output.

As examples, answering the research question and meeting the research objective includes answering questions[11] such as:

- Is it possible for a business model designer to describe a sustainable business model using the practitioner tool derived from Osterwalder's work (the Business Model Canvas – BMC)?
- What are the constructs and relationships required to describe sustainable business models that are missing, incomplete or surplus in Osterwalder's research (the Business Model Ontology – BMO)?

2.3 Introducing the Overall Research Approach

This project is seeking to solve a problem in the world at large by creating something useful. Hence this is an applied research project, deeply rooted in the literature and theory, which attempts to create a solution to the identified problem. The process of creating a solution enables the exploration of: the problem, the utility of the solution and the chosen methodological approach. In turn the process of exploration and its various outputs will generate a range of new knowledge.

[11] See chapter 6, the detailed evaluation research design for the detailed questions this research will attempt to answer).

This approach requires four inter-related streams of activity:

1. Preparation
2. Build
3. Evaluation
4. Communication

The basis for choosing the epistemological approach for this research along with the overall and detailed process for under taking the research is justified and described in Part II. Part II also presents the review of the literature that supports the proposed solution: artefacts which meet the research objectives and allow a response to the research question. These artefacts and the solution they offer is described and their utility evaluated in Part III.

2.4 Working Hypotheses

Yin points out (Yin, 2009, Box 4 p.29) that in exploratory research while there are unlikely to be formal propositions for the proposed study, it is still important set out ahead of the journey of exploration the expectations of and the rationale for the approach to be taken (however mistaken they turn out to be). Indeed any gap between the working hypotheses and the results is potentially a contribution of the research.

To this end, I have established the following working hypotheses:

WH1. A model of business that can be used to describe designs of sustainable business can be built from existing knowledge of business models and sustainability.

- Such a model of business contains the constructs recognized as being important for the description of concepts relevant to:

  WH1.1. an existing business whose goal is primarily monetary profit.

  WH1.2. a business that is choosing to include one or more sustainability best practices.

- Such a model of business can be used to describe:

  WH1.3. Patterns of sustainable business designs described in the literature and practice

  WH1.4. Business designs that exhibit various levels of sustainability (low to high)

WH2. Current conceptions of business models are largely inadequate at conceptualizing sustainability.

WH3. A model of sustainable business is perceived by managers as having validity and value. The model delivers value by allowing managers to understand gaps in their organization's approaches to increasing sustainability (these gaps vary between organizations, and by groups of organizations – such as firms in a particular sector; the are many reasons for these gaps)

WH4. A good starting point for helping managers increasing the sustainability of their organizations is to highlight gaps between current business design and potential future business design(s) and then identify reasons for those gaps.

2.5 Axioms

Throughout this research project the following axioms were taken as true and without controversy:

1. Models are useful means to represent researchers and practitioners views of their realities.

   However, this is not say that models are unproblematic particularly when they are assumed to be 'real' in some practical way (Falconer, 2005).

2. The study of models of business designs is useful to researchers and practitioners.

   Models of business designs are useful conceptions of a business to aid managers in the establishment and evolution of businesses and to aid researchers in theorizing about business. As evidence of this, consider that (all) hard and soft systems methodologies for management include a modeling step (Jackson, 2000).

   For example Ackoff's Social Systems Sciences method includes Idealized Design (pp.232-237), Warfield's approach is based on conceptual models developed by the Science of Generic Design (p.214), Checkland's Soft Systems Methodology includes as step 4 "conceptual models of the relevant systems" (p.252), Senge's Fifth Discipline includes building mental models (p.270), Beer's Organizational Cybernetics includes the Viable Systems Model (p.157) and this model has also been used in a number of subjective approaches (pp.272-280).

3. The study of patterns of business designs are useful to researchers and practitioners.

   Falconer states patterns "aid in the shared recognition of phenomena, allow for subjective interpretations and evince individual learning and collective dialog" (Falconer, 1999; Falconer, 2001, p.4).

4. Relevant, albeit incomplete, knowledge about sustainability and business design exists.

Sufficient theory of sustainability and business designs exist (albeit independently and at different points of development and acceptance) to make possible an exploration of a model of business that conceptualizes both.

5. Changes required to businesses' existing designs to create sustainable outcomes are significant.

   The efficiency-substitution-redesign (ESR) framework (Hill & MacRae, 1996) can be described as a maturity model of organizational sustainability[12]. Efficiency and substitution levels of this model of organizational change do not employ double-loop-learning to question underlying assumptions, and hence are highly likely to lead to "less unsustainable" outcomes (McDonough & Braungart, 2002, pp.45-48 "Why Being 'Less Bad' is no Good") rather than the learning required to achieve proactively sustainable ones (M. K. Smith, 2001).

6. Some practitioners are attempting, and will be interested in attempting, the design and creation of businesses that enable sustainability outcomes.

The above are taken in this research taken as true and without controversy. However, in conceiving of this research, two other assumptions were made that the subsequent literature review identified has having some uncertainty. For completeness these two assumptions are stated here as the axioms they were believed to be (a justification for their validity is included in Chapter 3).

7. Designing (building and evaluating) is a way of generating valid knowledge.

8. Systems approaches are required to conceptualize sustainability and to undertake research related to organizational sustainability.

[12] Personal communication with Prof. Rod MacRae.

2.6 Designed Limitations

When going on a journey it is also important to define places one is not attempting to reach. In this research the following are excluded for practical reasons of time and effort. They are however, known to be required in order to fully evaluate and subsequently optimize the practical use of the output of this research[13].

L1. The changes to a business model over / through time.

L2. Details of the business process designs required to execute an implemented business model.

L3. Human organizations that do not attempt to create a net monetary profit (e.g. NGO, government, regulators, etc.)

L4. Use in a design setting or mode, i.e. the use of the model of sustainable business to create new / changed business designs inspired by new / changed strategies[14].

L5. Longitudinal evaluation of the efficiency of creating high quality results using the model sustainable business and the subsequent instantiations of such designs in operating firms, i.e. evaluating the sustainability outcomes of businesses implemented from business designs created using the model of sustainable business.

L6. Building and designing a process (a design methodology):

- To create high quality (reliable, consistent, effective) designs of sustainable businesses.
- To create an operating business from a design described using the model of sustainable business.
- That attempts to maximize the efficiency of business model designers creating and implementing business designs using the model of sustainable business.

[13] Undertaking additional research to further evaluate and optimize is planned to be the focus of future practical work and academic research, and is described in Chapter 11.

[14] This thesis does evaluate the utility of the model of sustainable business to ***describe*** sustainable businesses (i.e. the evaluation is of the model's utility to describe and not its utility to aid in the creation of new or changed business designs).

L7. The definition of the principles for creating sustainable business designs[15], descriptions of patterns of sustainable business designs, metrics for the measurement of an operating business against such principles and patterns, nor threshold values of the metrics that identify the minimal level of adherence to the principles and patterns that would allow a business to claim it was sustainable[16].

All these limitations are considered areas for future research. As such they are discussed in Chapter 11.

2.7 Deepening Understanding of the Research Question, Goal, Approach, Working Hypotheses and Axioms

The reader will have noticed in the above a gap between the terminology used and the title of this research "Towards an Ontology and Canvas for Strongly Sustainable Business Models: A Systemic Design Science Exploration". In the above definitions of the specific (technical) terms in the title have not been used; instead general (and perhaps more lay) terminology has been adopted, i.e.

- Model has been used rather than ontology.
- Tool has been used rather than canvas.
- Sustainable has been used not strongly sustainable.
- Model of business or business design has been used rather than business model.
- Creation has been used rather than design and / or design science.

This is deliberate. To understand the technical terminology of the title requires an extensive review of the appropriate literature which is neither appropriate for an introduction, nor reflective of my own experience of the process undertaking this research. My own

[15] However, given the very high proximity of the literature reviewed to the development of strongly sustainable business design principles, and the high utility to business model designers that such strongly sustainable business design principles could have, an initial exploration is included (4.7.2 and 7.7)

[16] Recently Dr Bob Willard, The Natural Step Canada and B Lab have started to refer to the threshold values of such metrics as a "Gold Standard" for organizational sustainability (The Natural Step, 2013). The author is engaged in work with these individuals and groups in creating such a standard; the literature review presented in Chapters 2 thru 4 is one input to this effort.

understanding followed this same path: from a lay persons understanding of the terms as used in this introduction, through a learning journey in the relevant literature and with experts, to a deeper appreciation of the problem and solution domains, along with appropriate (technical) vocabulary.

Part II records this journey and culminates in a (subtle) restating of the above research question, goal, approach, working hypotheses and axioms, based on the deepened understanding of the problem and solution domains and of the approach to their exploration.

2.8 Thesis Structure

This thesis is organized as shown in Figure 2-1. The rationale and precedent for this structure is provided in II-3.

Part I: Describes the context for, origins and goals of, as well as the overall approach for undertaking this research (Chapters 1 and 2)

Part II: Is focused on the research processes. It describes the results of the journey through the literature and the resultant research design:

- The choices made to design the research, including reviews of the relevant literature which describes the conceptual framework and identifies the key theoretical frames for the research (Chapter 3).
- The resultant detailed research design consisting of activity streams identified above: prepare (Chapter 4), build (Chapter 5) and evaluate (Chapter 6)[17].
- A description of the key theoretical frames that informed the creation of the model of sustainable business, summarized as statements of the principles underlying the design of the model of sustainable business (Chapter 4).

[17] This document is the first output of the fourth stream of activity of this research (communication). Other communication is planned, see Chapter 12.

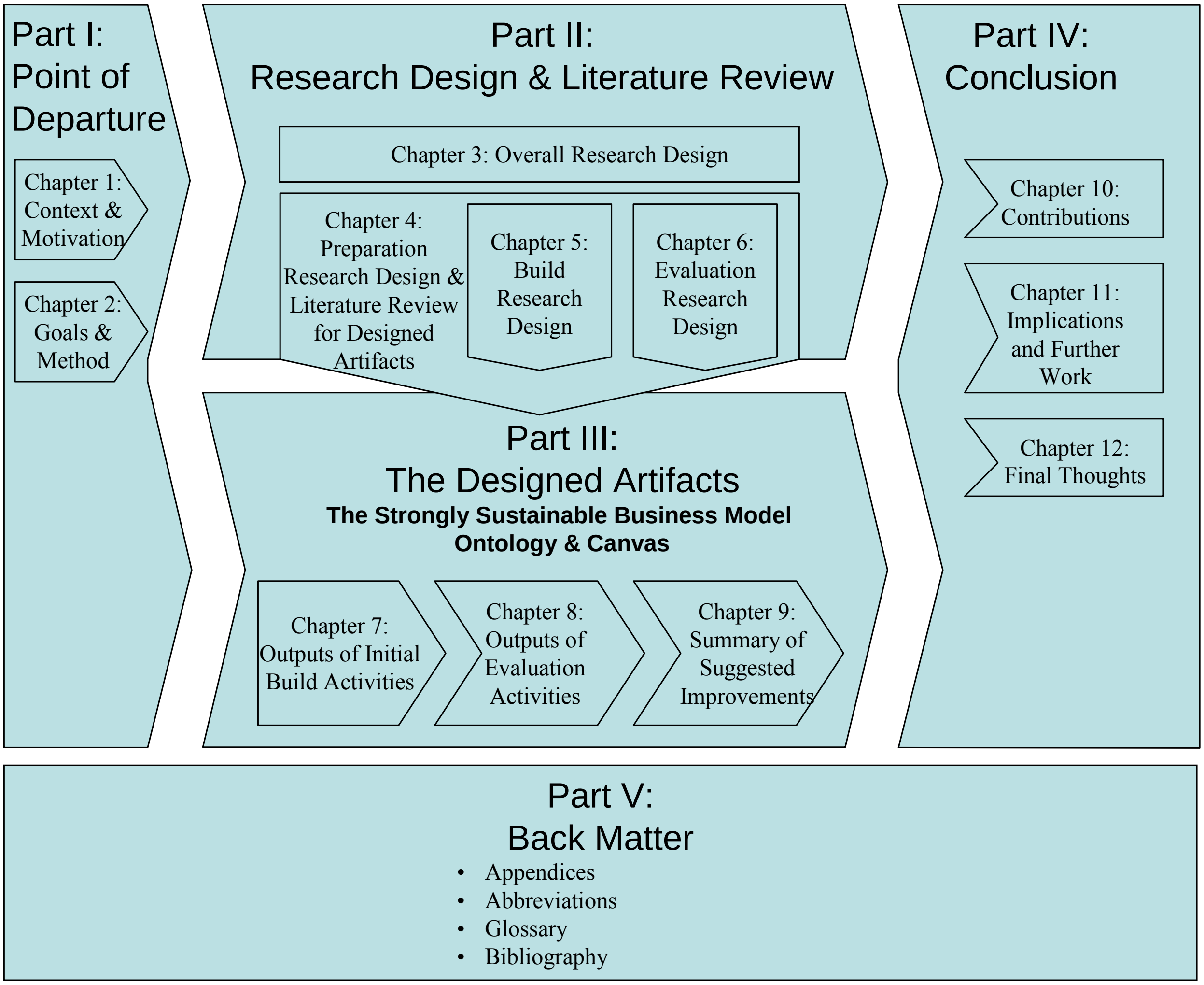


Figure 2-1: Structure of this Thesis

Part III: Is focused on the detailed knowledge output from the research. It describes the execution of the research design:

- The output of undertaking the construction of the model of sustainable business, including details of the knowledge from the key theoretical frames used within the model (Chapter 7).
- The outputs from the evaluation the utility of the model (Chapter 8).

- The analysis of the evaluation results, leading to suggestions for improvement that could enhance the utility of the model (Chapter 9).

Part IV: Describes the contributions (Chapter 10), implications and further work arising from this research (Chapter 11) as well as final thoughts on this work (Chapter 12).

Part V: Contains the back matter: the supplementary materials (listed in the front matter), the abbreviations, annotated glossary and bibliography.

Part I: Closing

The End of the Beginning

This part has described the context, origins and goals of, as well as the overall approach for, undertaking this research project.

Part II: Research Design and Literature Review
Starting the Journey

The plan is nothing; the planning is everything — Dwight D. Eisenhower

This part describes my journey through the literature and its results:

- The choices made to design the research, including reviews of the literature that describes the conceptual framework for the research and identifies the key theoretical frames (Chapter 3).
- The resultant detailed research design for the three activity streams: prepare (Chapter 4), build (Chapter 5) and evaluate (Chapter 6).
- A description of the key theoretical frames which informed the creation of the model of sustainable business (the result of the prepare activity, hence also included in Chapter 4).

II-1 A Word on "Design"

Design and designing has been a feature of human behaviour for a long time, clearly stretching back into pre-history. Someone always has to have an idea first and then afterwards take steps to realize that idea. However subconsciously or informally the idea is generated or expressed, the creation and expression of an idea is an example of the process of design.

The formalization of design as a concept, a process and a noun[1] started during the early part of the industrial revolution, and is connected to the development in practice of Adam Smith's concept of the division of labour (Hubka & Eder, 2001; O'Rourke, 2007).

Design appears to be a complex idea: As an illustration Hubka, in his introduction to Design Science, spends 16 pages defining the term 'designing', including citation of 20 other

[1] As in "design thinking designs good designs".

authors' perspectives, which Hubka introduces simply as "some examples" (Hubka & Eder, 2001, pp.2-18).

Design is increasingly recognized as relevant to the achievement of sustainability and flourishing and vice versa. Ehrenfeld sees creating "sustainability by design" as a "strategy for transforming our consumer culture" (Ehrenfeld, 2008; Hopkins, 2009), while Shedroff in his recent guide for product and service designers suggests that "design is the problem" and that "the future of design must be sustainable" (Shedroff & Lovins, 2009).

In explaining the development and design of this research it is hoped that the approach taken in this part remains comprehensible despite the cognitive complexity of design.

II-2 A Process for Designing the Research Design of Design Research[2]

Setting out to undertake research such as this which aims to create knowledge through an exploration of a problem and the utility of a solution has several challenges.

There is the challenge of **recursion**: Undertaking such research is, to use the term colloquially for the time being, a process of design: searching the chosen problem and solution domains for the 'best'results. The creation of the steps to undertake such research is also a process of design: searching for the 'best' way to undertake the research. This is turn raises the question of how to determine the way to search for and select this 'best' way (which is of course also a design process). Thus we need to design the process to design the research to undertake the design of a solution. One may keep asking this question ad infinitum - descending the rabbit hole and tying ourselves in conceptual and explanatory knots: it becomes conceptually more complex to undertake, describe and hence difficult for the reader to understand.

There is also the challenge of **choice**, alluded to above: A process that aims, due to the academic context, to produce knowledge which will be judged scientifically valid, but that includes as a key element a researcher choosing a 'best' answer, is problematic[3]. The

[2] Aka meta meta design – hence this section is presented outside any chapter.
[3] This is not a problem unique to the research approach selected. As one example: any scientific experiment requires the researcher to choose a design for the experiment and hence requires the researcher to exercise their judgement, based on their values, to select the 'best' experimental design and then justify it.

legitimacy of knowledge produced by the scientific method, as commonly understood, attempts to minimize bias from all sources – particularly from what are often regarded as (highly) unreliable individuals, their normative values and idealized goals.

The chosen responses are material to this research since they directly impact the achievement of the first detailed research objective:

> **RO0**: The research design will be of the highest quality possible: minimizing bias by maximizing rigour, hence maximizing the legitimacy of the research output.

The challenge of recursion makes it hard to know where to begin and to describe beginnings – how many recursions deep does one go? What is the ultimate cart, what is horse? The challenge of choice makes the achievement of rigor and hence validity of the resultant knowledge difficult: if ‘best’ is a personal choice, why is one person’s choice more or less valid than someone else’s?

The ‘best practice’ advice found in the literature presented in the four chapters of this part suggests that both challenges may be legitimately resolved by stating and then consistently following a process for choosing – i.e. attempting to maximize rigour. This, the literature states, does not resolve the challenges. However it significantly increases the likelihood that assumptions in the researcher’s choices (i.e. bias) will be explicitly surfaced for examination by the community. Veracity can then be more easily judged and legitimacy of the research output determined.

To follow this advice a common process was synthesized: a consistent starting point and process for choosing the ‘best’ that explicitly exposes the basis of the researcher’s choices. This is shown in Figure II-1.

By its explicit presentation and use this process attempts to consistently and explicitly surface the researcher’s choices in both how this research was undertaken and what knowledge was deemed relevant to those choices.

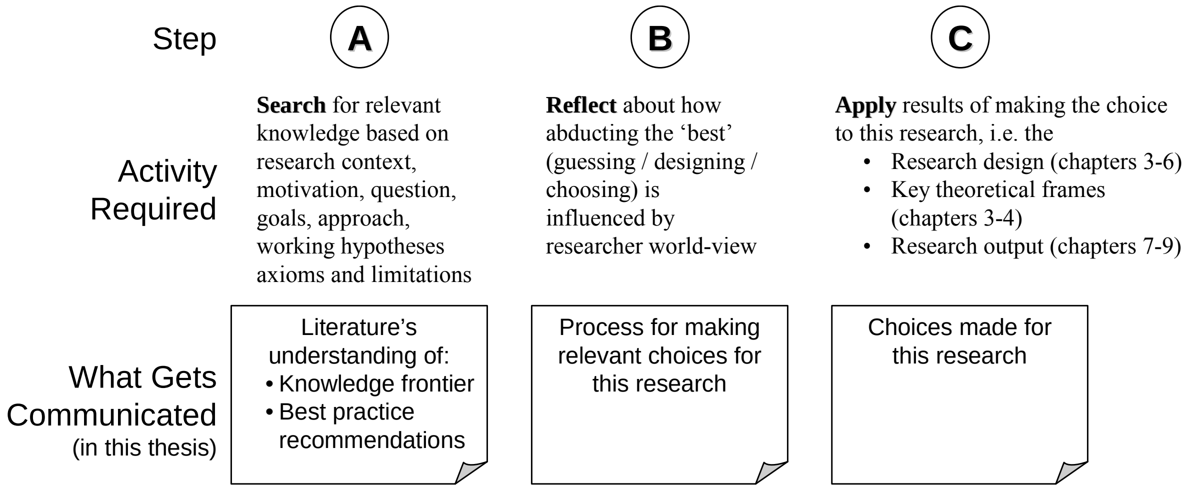


Figure II-1: Steps to Make Choices and Increase Validity by Consistently Surfacing Assumptions

These three steps were consistently used in the design and execution of this research. It is believed that this has increased the rigor and hence the legitimacy of the research results.

Repeated Use

Firstly: within each chapter the three steps are applied repeatedly and as required to ensure rigour in each choice relevant to the topic at hand. In some chapters (e.g. 3) the three steps are repeated a dozen or so times to help choose the best overall research design. In other chapters (e.g. 6) the three steps are applied once to help choose the best detailed evaluation research design.

Iterative Use

Secondly: To handle the conceptually complex nature of the problem and solution domains, and the (necessarily) reflexive relationship between the creation of the research design and its execution, the three steps were applied in three iterations. The output from each iteration becomes the context for and the process to undertake the next iteration. This is illustrated in Figure II-2.

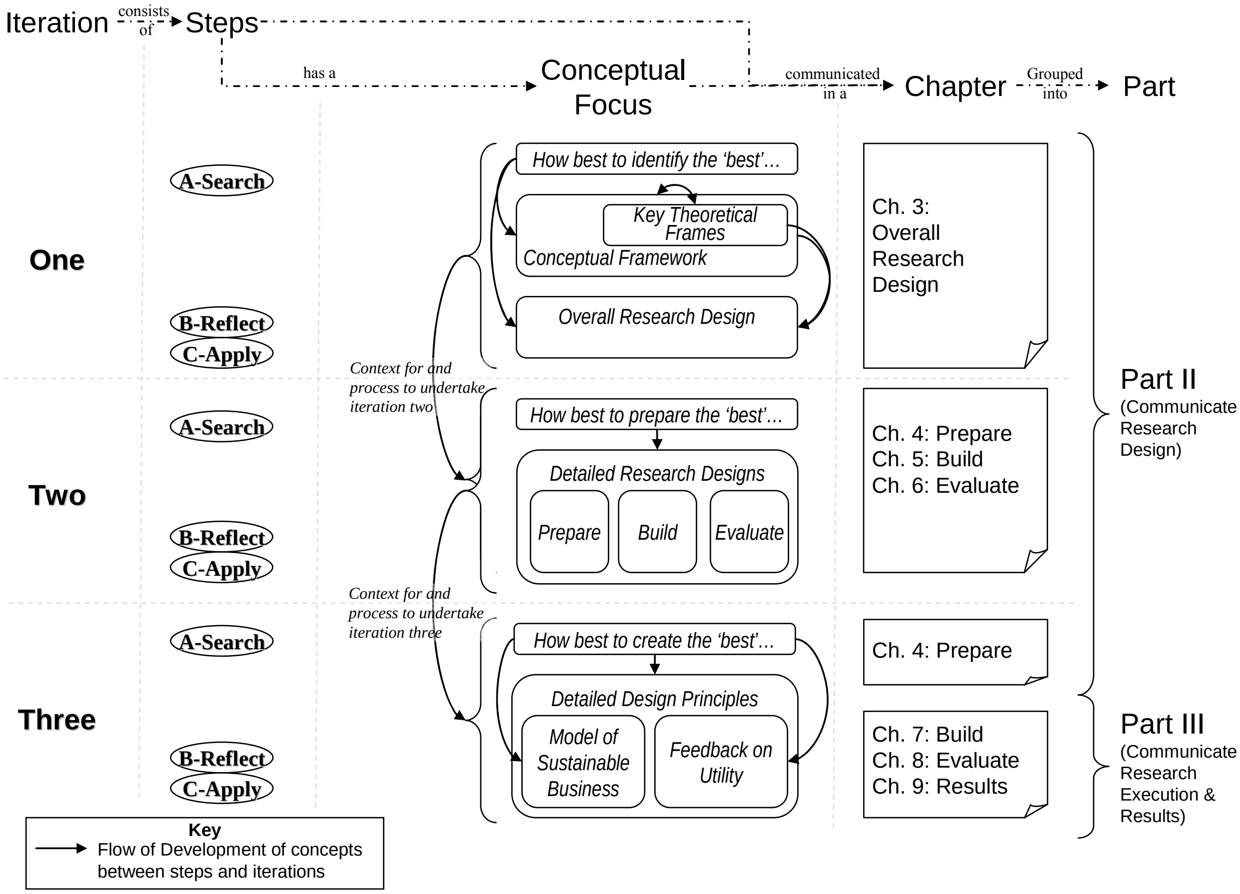


Figure II-2: Three Iterations to Construct Research Design

(Additionally, within each iteration the steps are used repeated based on the topic at hand)

In **iteration one** the three steps were applied to attempt to take the best approach to search for the relevant research conceptual framework and key theoretical frames (step A) and subsequently to choose the best overall research design (steps B & C). The overall research design has four activity streams (prepare, build, evaluate and communicate[4]). This iteration and its results are described in Chapter 3.

In **iteration two**, the three steps, now embedded into the overall research design chosen in iteration one, were applied to search for the relevant detailed research designs for the prepare, build and evaluate activity streams (step A) and subsequently to choose the best detailed

[4] The self referential nature of describing the communication activity stream in one of that streams outputs, this thesis, was found needlessly complicated; Hence the communication activity stream is omitted from all but two diagrams in this thesis (Figures 3-21 and Figure II-3).

research designs (steps B & C). This iteration and its results are described in chapters 4 (prepare), Chapter 5 (build) and Chapter 6 (evaluate).

In **iteration three**, the three steps, now embedded in the detailed research designs chosen in iteration two, were applied to search for the relevant details of the key theoretical frameworks chosen in iteration one and to record this in the detailed design principles (step A). Subsequently these detailed design principles where used to create [5] the best model of sustainable business and undertake its evaluation, gathering the best feedback possible on the models utility (steps B & C). This iteration and its results are described in chapter 4 (prepare), Chapters 7 & 9 (build), Chapters 8 & 9 (evaluate).

II-3 Communications Activity Stream

Designing the Structure of this Thesis

This document is the first formal output of the communication activity stream. How was it designed? How was the logic of the structure shown in Figure 2-1 determined to be the best?

While not shown in Figure II-2, to ensure rigour in the design of the communications activity stream, the same three step process of search (A), reflect (B) and apply (C) was also followed.

A search (A) of the literature identified a recent recommendation by noted management information systems design science researcher Alan Hevner. He suggested an appropriate structure for reporting on applied design research (Hevner, 2011, slides 30-31).

Reflecting (B) on this advice it was realized that in this research there is tension between:

- The requirement to take the advice of the literature that the highest level of rigour is achieved through the use of different and differing combinations of research techniques in each of the activity streams. This requires a significant amount of complexity (and length) of the research design.

  and

[5] i.e. build / choose / design the model of sustainable business.

- The conceptual grouping of research tasks into activity streams to aid planning and description of the research, the tasks as undertaken over time (which may involve iteration of tasks across the activity streams), and the necessarily linear sequence of communicating the research and its results.

The recursive challenge introduced in II-2 makes these tensions particularly acute in this research.

This reflection led to the identification of a These communications Design Principle (TDP) for the structure of this thesis in order to attempt to mitigate these tensions:

TDP: In this thesis, the complexities are made comprehendible by sequencing the description of the research by increasing levels of detail of its results, and not by topic nor in the conceptual or actual sequence of the tasks that produce the results.

This (hopefully) enhances comprehendability by:

- Grouping presentation of results at similar levels of detail and the manner in which these results were obtained.
- Sequencing the presentation so that logic within and between the increasing levels of details are apparent.

This thesis communications design principle was then applied (C) by:

First, examining Figure II-2. This shows the conceptual sequence of the tasks as the three step process is used in three iterations to create the overall research design (iteration one), detailed research designs (iteration two) and the overall results of this research (iteration three). It was concluded that this structure does not follow the thesis communication design principle.

Second, examining Figure 3-21. This shows the overall research process (project plan), including the groupings of research tasks into four activity streams, and how tasks within these streams are executed in parallel over time, with multiple feed forwards and feedbacks of interim and final results. It was concluded that this structure does not follow the thesis design principle.

These examinations led to identification of the logical flow in which the details of the research results emerged, and hence the easiest manner of understanding the research. This led to the application of the thesis design principle, resulting in the thesis structure, as shown in
Figure 2-1:

- Chapter 3 describes the overall research process.
- Within the context of these results, Chapter 4 develops the more detailed process for undertaking the preparation activity stream and describes the detailed design principles.
- Within the context of both the overall research design, and the detailed design principles Chapters 5 and 6 develop the detailed designs for the build and evaluation activity streams.
- Within the context of all the activity stream detailed designs and the detailed design principles Chapter 7-9 describes the model of sustainability business and its evaluation.
- Finally Chapters 10-12 conclude on the contributions and areas for further research.

Design of Other Activities and Outputs of the Communications Activity Stream

Other activities and outputs of the communications activity streams required to ensure rigour were identified during the above literature search and in the university processes for undertaking any graduate research. Further the necessary involvement of others in the remaining three activity streams also involved considerable communication.

As it bares upon research rigour and output legitimacy this communication is described in the relevant chapters.

II-4 Final Remarks on Recursion

Darkening these pages for the final time with the challenge of recursion concludes the introduction to this part.

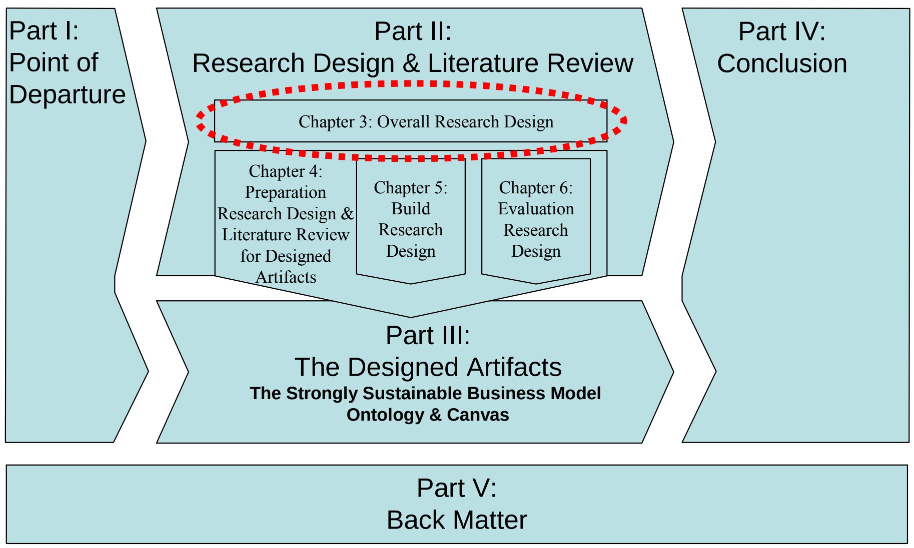
Some might consider there to be lack of citations in this section and hence a researcher bias: an over reliance on ‘common sense and logic’.

This is a result of an explicit, but ultimately arbitrary choice of the level of recursion to go to – albeit one driven by philosophical, epistemological and ultimately practical considerations of time and effort. It is hoped that the reader, having reviewed the advice from the literature presented in the four chapters of this part, will support the use of the three steps as described above and find this approach to the creation and undertaking of this exploratory systemic design science rigorous and hence its output legitimate.

Chapter Three: Overall Research Design

You cannot, in human experience, rush into the light. You have to go through the twilight into the broadening day before the noon comes and the full sun is upon the landscape — Woodrow Wilson

We are searching for some kind of harmony between two intangibles: a form which we have not yet designed and a context which we cannot properly describe
— Christopher Alexander



Applying the three steps set-out above, this chapter describes the search (A) of the literature for relevant conceptual frameworks and the identification of key theoretical frames required to create the overall research design. From this search a reflection (B) that applies (C) the choices made to create the overall design of this research are presented.

3.1 Introduction

In the creation of the overall research design, this chapter makes a set of choices that lead to an approach to meet the research objectives (see 2.2). All the choices relate to answering the question:

How should the research problem and solution domains be best understood?

To answer this question the three steps set-out at the start of part II (A-Search, B-Reflect, C-Apply) are used repeatedly to explore each aspect of a research design. The results of each repetition of the three steps are then combined to create the overall research design (this chapter).

In summary the review of the literature presented in this chapter strongly suggests that the ability of a researcher to meet the research objectives rigorously and achieve a high quality of results is highly dependent on the level of preparation of the researcher; i.e. does the researcher consciously understand and can they justify, based on legitimate precedent:

- Their world-view / biases,
- The objectives of the research design process
- The process to be used to undertake the design of the research
- The rationale for this process
- How the research design will be executed to meet the objectives of the research

3.1.1 Chapter Structure

As noted, three steps are used repeatedly to increase research rigor by making explicit the choices made in the overall research design described in this chapter: search (A), reflection (B) and application (C). In each repetition the results of the search, reflection and application of the literature elaborates the overall research design in a step-wise fashion; arriving, at the end of the chapter, with the final overall research design.

This reflects the process used to develop the overall research design. It contributes to its comprehension by:

- Sequencing the description based on the rationale used to develop it.
- Structuring the explanation and the choices into logical chunks.

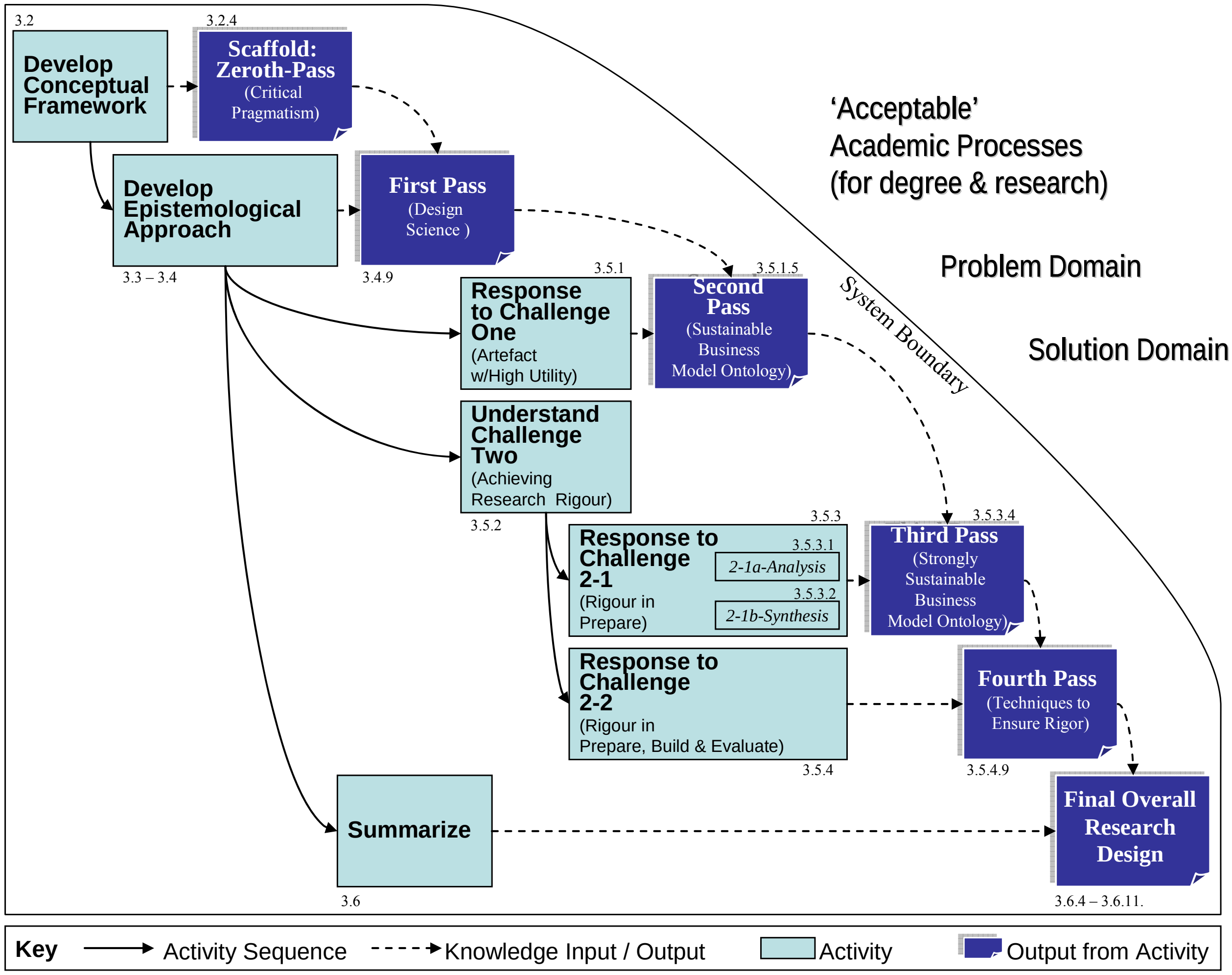


Figure 3-1: Overall Research Design Process and Its Context[6]

As show in Figure 3-1, this chapter unfolds as follows:

- Section 3.2 describes the development of the research conceptual framework, including the identification of the key theoretical frames, driven by the research objective. A first Overall ontology Design Principle is identified (ODP1).

[6] i.e. This is the ideal-seeking purposeful system of inquiry whose goal is to create the 'best' research design given the research goal – see Footnote 77 for a fuller description in light of the systems thinking terminology introduced in 3.5.2.2.

- This results in a scaffold for the overall research design (Figure 3-2). This scaffold is then elaborated by the repeated application of the three steps during this chapter to arrive at the final overall research design.
- Section 3.3 describes the overall domain of the problem of organizational sustainability, paying specific attention to the difficulties that have and will continue to arise due to the epistemologies predominantly employed in the field.

  The chosen resolution in this research design to these difficulties is presented in the following section.
- Section 3.4 describes the selection of the over-arching epistemological approach to the problem and solution domains: design science. This results in the first pass of the overall research design (summarized in Figure 3-8).
- Section 3.5 reviews, from a number of perspectives, two challenges identified by the literature to undertaking rigorous design science organizational sustainability research: (1) what output, known in design science as an artefact, has high utility to managers and (2) how to ensure rigour. These two challenges are explored in the following sections:
  - Sub-section 3.5.1 describes the selection of the artefact, an ontology, that the literature suggests will be useful in meeting the research objectives. A second Overall ontology Design Principle is identified (ODP2).

    This results in the second pass of the overall research design (summarized in Figure 3-12). This integrates information / computation formal science which has an epistemology relevance to ontology creation (ontology engineering) and the knowledge of the internal structure of an ontology.

    The research design is also revised to include the first key theoretical frames relevant to the problem and solution domains from the organization and management fields: innovation, strategy, operations and information systems management, including business models.

- Sub-section 3.5.2 describes, from a number of perspectives, the overall problem of achieving rigor in design science organizational sustainability research.

  This leads to the identification of two critical aspects of the problem and solution domains:

  1. How to best understand the domains (i.e. sustainable organizations and their contexts)
  2. How best to rigorously research the domains to meet the research objective.

  The chosen resolution to these two aspects of achieving research rigor is presented in the following two sub-sections.

- Sub-section 3.5.3 describes the selection of a third epistemology that the literature suggests will best enable a rigorous understanding of the problem and solution domains: systems thinking. This results in the third pass of the overall research design (summarized in Figure 3-14).

  The third pass of the overall research design integrates the formal science of systems that has an epistemology relevance to ontologies and organizational sustainability (soft systems).

  The research design is also revised to include additional relevant key theoretical frames: natural and social science knowledge which has been created using systems thinking approaches. This includes: physics, chemistry, biology, and ecological sociology, economics and management. These key theoretical frames contain the knowledge about sustainability (weak and strong definitions are introduced).

- Sub-section 3.5.4 describes, based on the chosen epistemologies (design, ontology engineering and soft systems) the literature's advice on maximizing research rigour. This results in the fourth pass of the overall research design (summarized in Figure 3-16).

The fourth pass of the overall research design chooses from and applies the advice on research rigour (setting objectives, iteration, setting boundaries, world-view identification and triangulation diversity).

- Section 3.6 concludes this chapter and summarizes the final overall research design (summarized in Figure 3-20).
  - Sub-section 3.6.2 summarizes the overall process used to develop the overall research design and suggests that this process helps confirm its validity.
  - Sub-section 3.6.3 provides a commentary on the context for the chosen artefact and methodological approach.
  - Sub-section 3.6.4 uses frameworks suggested by the literature, and introduced during the chapter, to summarize the overall approach to achieving research rigor.
  - Sub-sections 3.6.5-3.6.9 summarizes the research scope, overall research design, the boundaries of the artefacts to be created, and the process of inquiry which creates them. The research design principles and research objectives are restated in light of the specifics of the chosen conceptual framework, key theoretical frames and overall research design.

  To conclude the chapter

  - Sub-sections 3.6.10-3.6.11 review research biases and other identified difficulties that might hinder achieving the desired level of rigor and hence the research objectives
  - Sub-section 3.6.11 comments on meeting the research objective and confirming the working hypothesis in light of the overall research design.

3.2 Conceptual Framework

As noted in part I practical considerations require a starting point for any story, however arbitrary. In this chapter the story to be told is of the choices that led to the overall research design, a research design whose execution meets the research objective.

The chosen starting point is the presentation of a conceptual framework for this research based on the research objectives. This choice was inspired by:

- A recent essay for the Journal of Operations Management forum calling for an "innovation mindset amongst practitioners and researchers", i.e. new approaches (Holmström & Romme, 2011).
- The systems thinking idea, identified by one of the founders of the York Faculty of Environmental studies as underpinning its establishment: understanding the context of what is to be studied and how it is to be studied is as important as the resultant study (Morley, 1997, revised 2010).
- The observation that "choosing an appropriate research strategy is difficult […requiring] a deep an honest reflections of one's own beliefs [and…] commitment to the philosophical trinity (ontology, axiology and epistemology)" (Durant-Law, 2005, p.ii).

Using this conceptual framework the three steps (Search, Reflect, Apply) are then undertaken to choose, at this end of this section, the scaffold for the overall research design.

3.2.1 Search

3.2.1.1 Definition

This last author, Durant-Law (2005), suggested based on his review of the literature, that any research conceptual framework should contain the three elements shown in Figure 3-2, which he refers to as the "philosophical trinity" [7]:

The following three headings explore each of the elements of a conceptual framework shown in Figure 3-2.

[7] This work was prepared as part of Durant-Law's subsequently awarded PhD; its clarity recommended its reuse.

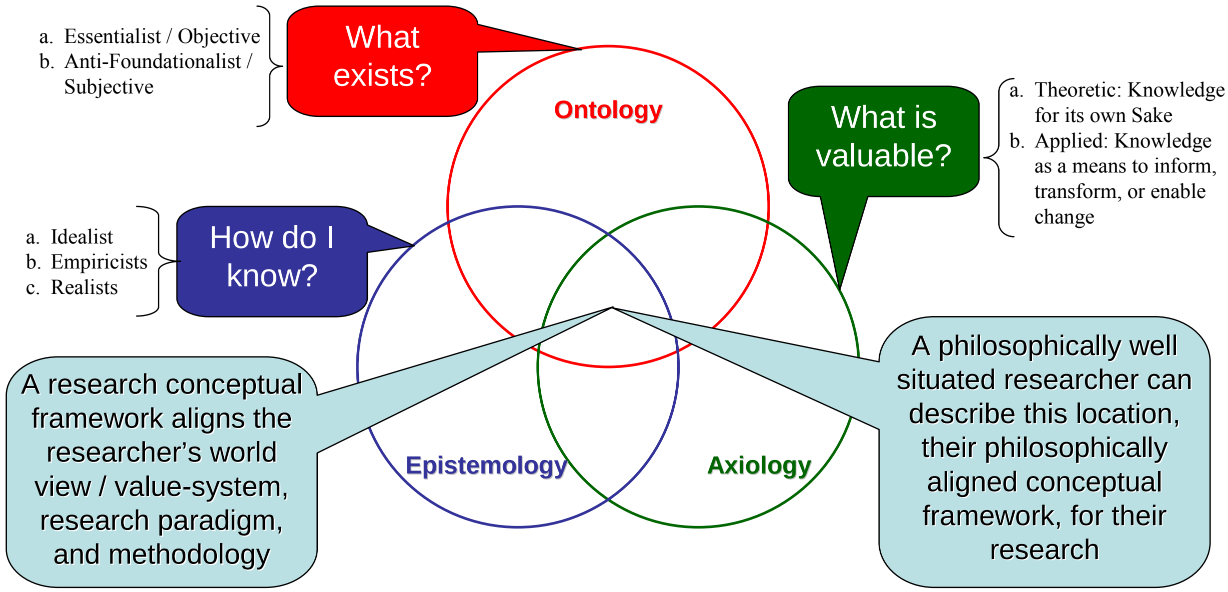


Figure 3-2: Elements of a Conceptual Framework
(Derived from Durant-Law, 2005, Sect.2 & Fig.1)

3.2.1.2 Ontology – What Exists?

Ontology is the study of being, perhaps first undertaken by the Greeks. A present day academic in business, public administration and law, Durant-Law, identifies two distinct possibilities for how we can choose to understand being:

> *A. The **essentialist** school argues that there are fundamental and enduring differences in social phenomena that exist in all contexts and across time. Such a position means that social phenomena can in essence be decomposed to constituent parts.*
>
> *B. On the other hand the **anti-foundationalist** school says that all social phenomena are socially constructed and as such must be positioned in time, space and culture.* (Durant-Law, 2005, p.5)

These are the most common perspectives and are often conceived of as mutually exclusive alternatives.

3.2.1.3 Epistemology – How to Know?

Epistemology is shaped by the researchers ontological bias, since how one comes to know will be shaped by one's stance towards being. Durant-Law identifies three distinct possibilities for how we can know:

> *A. **Idealists** subscribe to the view that all knowledge refers to a human consciousness rather than an objective reality and that reality does not exist independently of consciousness. Idealist epistemology takes many forms, the most common being rationalism, which tends to treat knowledge as the construct of the process of actually knowing.*
>
> *B. **Empiricists** suggest knowledge is derived through sensation, and that the process of knowing is largely passive. In this sense knowledge is a photocopy of what exists outside consciousness, albeit an incomplete and somewhat distorted photocopy. For an empiricist ontology and epistemology are virtually identical, because what is known is the same as what is.*
>
> *C. **Realists** believe that knowledge is gained from our senses **and** the use of reason. Reason makes use of principles and categories that do not emanate from the object of knowledge, but rather are derived from experience and reflection. Further they maintain that perception is mediated by social and cultural factors, and therefore is not an independent phenomenon as posited by empiricists. In this sense a realist epistemology sees knowledge as both created and constructed, and that the result is more or less an accurate depiction of the object or phenomena as it exists.* (Durant-Law, 2005, pp.5-6)

3.2.1.4 Axiology – What is Valuable?

Ontology and epistemology deal with truth: what exists and how to know it. Axiology is about values. It consists of the fields of ethics, pragmatics and aesthetics which are used evaluate the rightness or goodness of the knowledge framed and gained by the researcher's ontological and epistemological stance. In turn the stance is based on the ultimate purpose of the inquirer (Durant-Law, 2005, p.6).

Durant-Law found that the literature is far less specific about axiological positions, but that perhaps two possibilities for determining value can be discerned:

> *A. The first position is valuing knowledge for its own sake and as an end in itself: this is the Aristotelian School. Simple understanding is valued above all else. [‘**Understanding’**].*
>
> *B. The second position values knowledge as a means to inform, transform, or enable positive change: this might be called ‘**Applied’**.* (Durant-Law, 2005, p.6)

3.2.1.5 Methodology – How to Discover What is Believed to be Valuable & Knowable?

Durant-Law advised that researchers should choose methodological approaches based on their choice of ontology, epistemology and axiology: how will particular method / technique combinations best enable discovery of what the researcher has determined they believe is valuable and knowable (Durant-Law, 2005, p.8).

This advice included the caution that increasingly in social science research it is recognized that single pairings of method and technique(s) often do not to lead to the ‘best’ methodological approach for a given research objective (R. B. Johnson & Onwuegbuzie, 2004; Yin, 2009, pp.62-64).

3.2.1.6 Possible Conceptual Frameworks – What Knowledge is Legitimate?

In his extensive review of the philosophical traditions of systems thinkers Jackson structures his analysis using what he calls “sociological paradigms” in order to “learn about what they take for granted about social science and society” (M. C. Jackson, 2000, p.22). Jackson’s paradigms have the same elements as Durant-Law’s philosophical trinities.

Table 3-1 provides some typical conceptual frameworks synthesized from both Durant-Law and Jackson.

Conceptual Framework (Tradition of Inquiry)	**Ontology**	**Epistemology**	**Axiology**	**Methodology**
Positivist	Essentialist	Empiricist	Understanding or Applied	Quantitative
Subjectivist (Anti-Positivist)	Anti-foundationalist	Idealist	Understanding or Applied	Qualitative
Constructivist (Anti-Positivist)	Anti-foundationalist	Realist	Understanding or Applied	Qualitative

Table 3-1: Typical Conceptual Frameworks
(Selected from Durant-Law, 2005, pp.6-7; M. C. Jackson, 2000, pp.22-25 & pp.41-42)

3.2.2 Reflection and Identification of Alternatives

These are some of those most commonly encountered conceptual frameworks, and are often conceived of as the only (mutually exclusive) alternatives.

However in United States in the late 19th century Charles Sanders Peirce[8], William James and others identified another possibility which is possibly better suited to this research objective: the pragmatist conceptual framework. Pragmatism is the idea that belief is knowledge upon which action is based.

> *Beliefs [about being] are really rules for action [hence] to develop a thought's meaning we need only determine what conduct it is fitted to produce: that conduct is […] its sole significance. And the tangible fact at the root of all our thought-distinctions, however subtle, is that there is no one of them so fine as to consist in anything but a possible difference of practice. To attain perfect clearness in our thoughts of an object, then, we need only consider what conceivable effects of a practical kind the object may involve – what sensations we are to expect from it, and what reactions we must prepare. Our conception of these effects, whether immediate or remote, is then […] the whole of our conception of the object, so far as that*

[8] Perhaps unsurprisingly, Charles Sander Pierce also originated abductive logic (in contrast to inductive and deductive inference) as "logical leaps of mind", i.e. informed guessing. Abductive logic is the foundation of design thinking, a practical approach to knowledge production and the epistemological approach chosen for this research (3.3-3.4) (Martin, 2009, p.25 & pp.62-68).

conception has positive significance at all. This is the principle of [Charles Sanders] Pierce, the principle of pragmatism. (James, 1907)

Hence the pragmatic ontology does not imply the researcher has a particular ontological or epistemological position: preferring instead to suggest that the researcher's practical experience in observation takes precedence, i.e. an applied axiology is the anchor of this conceptual framework.

Paraphrasing James, in this research the pragmatic approach is taken to mean:

> If something makes a difference in the understanding of the problem or in creating a useful solution then that thing matters

Hence a pragmatist draws, without concern, on essentialist and anti-foundationalist founded knowledge known through empiricist, realist or idealist epistemology, judged based on the practical contribution to or impact on the achievement of the research objective. Table 3-2 summarizes the pragmatist conceptual framework:

Conceptual Framework (Tradition of Inquiry)	**Ontology**	**Epistemology**	**Axiology**	**Methodology**
Pragmatist (Contextualist)	Either*	Any*	Applied	Any*

Table 3-2: Pragmatist Conceptual Framework
* As judged by the researcher based on the practical contribution to or impact on the achievement on the research objective

Jackson presents a review of pragmatism, which he suggests is systemically oriented, in "Systems Approaches to Management". This includes the identification of a significant concern: In pragmatism everything is contextual (for this reason pragmatism is sometimes called contextualism) and hence there is no place for or mechanism to apply ontologically and / or epistemologically bounded theory that could improve practical outcomes (M. C. Jackson, 2000, p.26, pp.365-266 & pp.382-383).

In his introduction to his review of Critical Systems Thinking Jackson suggests that the critical approach is defined by the researchers ability to use "critical awareness" – that is surface and be aware of (to critique) context. Through this process the researcher may become aware of "different ways of analyzing and intervening", because "the apparent strength and weaknesses [in any situation may] vary dramatically depending upon the paradigm from which it is observed and judged" (M. C. Jackson, 2000, pp.356-357).

This suggests that coupling critical approaches with pragmatism could help a researcher avoid the concern of contextualism by attempting to continuously surface the context of practical value. This process of surfacing may include any relevant ontologically or epistemologically grounded knowledge.

3.2.3 Choosing a Conceptual Framework and Identifying Key Theoretical Frames

Above the search of the literature identified and reviewed the elements of research conceptual frameworks. A common and an alternative research conceptual framework were described.

In this sub-section the reflect and apply steps will be undertaken to choose the conceptual framework for this research and identify the key theoretical frames.

3.2.3.1 Approach: Exploratory

The chosen exploratory approach was introduced in 2.3 based on the research objective of solving a problem in the world (Yin, 2009, pp.5-8).

A further investigation of the literature confirms the validity of the exploratory approach (see 3.5.2-3.5.3). There appears to be little in the way of theory which integrates models of business and sustainability as understood by systems oriented formal, natural and social science. Further while much has been written on the need for businesses and other organizations to become sustainable, current practice would suggest significant gaps in achieving this objective (Chapter 4). Given this state of theorization and description it would appear to be naïve to attempt an explanatory, descriptive or experimental approach.

In a survey of the literature on case study research in the Information Systems field showed that 52% of the articles were reporting on exploratory research – lending credibility to both the use of the case study method (see chapter 6 for use of this method within the evaluation activity stream) and the overall exploratory approach (Dube & Pare, 2003, Table 3 p.606).

Hence this research uses an exploratory approach to build and evaluate a model of business and sustainability using qualitative research methods / techniques. It will be for subsequent research to take this output and use it for description, theorizing and formal/quantitative justification / testing (Chapter 11).

3.2.3.2 Philosophical Bias: Critical Pragmatism

Considering the research objective of solving a problem in the world I attempt to maintain a critical pragmatic philosophical bias for this research. This is operationalized as follows:

> If, upon critical examination, an ontological or epistemological perspective makes a practical difference in achieving the research objective, as per the world-views of the researcher and/or managers in firms, it is to be considered.

This implies that the conceptual framework for this research consists of the following:

Axiology:	Applied	This research is not seeking to generate knowledge for its own sake but in order to make a change in the world. Hence knowledge produced is not of value unless it is used.
Epistemology	Any (Realist)	Chosen based on which epistemology yields results of greater practical utility toward the research objective, recognizing however that context, a prime and realist tenant of systems thinking, can, and often does matter.
Ontology:	Either	Chosen based on which ontological perspective yields results of

greater practical utility toward the objective, recognizing that systems thinking is biased towards the anti-foundationalist: properties may emerge from systems depending the human determined systems boundary (Ulrich, 2002).

This bias will guide the selection of methodology and technique as follows:

Methodology	Any	Methods / techniques will be selected based on their ability to yield the greatest practical utility towards the research objective. It is recognized that qualitative methods are practical in the chosen exploratory approach.

This approach enables the integration of the various traditions of inquiry that have a practical bearing on the research objective.

As per the critical tradition, reflecting upon the context for this choice, in light of the primary epistemological approach (design science, whose choice is described in 3.4), it is worth noting Heidegger's "hermeneutic circle" as the containing process in which this research is undertaken. In her recent review of the ontology of designing, Willis summarized the hermeneutic cycle in the context of design:

- *Design is something far more pervasive and profound then is generally recognized*
- *Designing is fundamental to being human, […] that is […] we deliberate, plan and scheme in ways which prefigure our actions and makings. [Hence as]*
- *We design our world, while our world acts back on us and designs us"* (Willis, 2006, p.80)

It is within this cycle that this research intends to achieve its objective.

Finally, selecting critical pragmatism also acknowledges that the researcher needs to take a humble approach. This follows the advice from Ulrich: a plea for what he calls "critical holism" (Ulrich, 1993). Ulirch's advice highlights the connection between achieving research rigor, the researcher who takes a humble approach, and the theoretical limits to knowledge production[9].

3.2.3.3 Key Theoretical Frames (K0)

In Chapter 1 a gap in the literature was identified: the lack of a micro-economic definition of sustainability that is compatible with the latest natural, social and formal science literature and its implications (1.3.1). This suggests that a key principle required to achieve the research objective relates to knowledge that would lead to a definition of organizational sustainability. Hence overall ontology design principle one:

> **ODP1**: The model of sustainable business is based on and is compatible with the latest natural, social and formal science knowledge on sustainability – its definition and achievement.

Continuing to use the term informally for the time being, organizational sustainability requires that organizations remain sufficiently monetarily viable (based on their stakeholders definition of sufficiently viable).

For example owners of a for-profit business[10] can choose the return on investment they find sufficient. On the other hand the board of a not-for-profit organization must achieve their objectives while maintaining a net monetary profit of zero[11].

This implies that any useful model of sustainable business must include knowledge of both monetary profitability and the integration of the achievement of environmental, social and monetary benefits (2.1).

[9] Ulrich urges researchers to take a critical approach since "this much is certain: the quest for comprehensiveness, although it represents an epistemologically necessary idea, is not realizable. If we assume that it is realizable, the critical idea underlying the quest will be perverted into its opposite, i.e., into a false pretension to superior knowledge and understanding" (Ulrich, 1993). Ensuring researchers remain humble is particularly important for organizational sustainability research given the incompleteness of relevant natural, social and formal scientific knowledge (discussed below).

[10] A definition of for-profit organizational viability embedded in much incorporation legislation in the Global North (B Lab, 2009)

[11] Again, the definition of non-profit organizational viability embedded in much legislation in the Global North.

This leads to a question:

What knowledge is required to understand the problem and solution domains, i.e. what are the relevant key theoretical frames for organizational sustainability?

Disciplinary approaches to research have their key theoretical frames determined by the accepted bounds of each discipline, broadly natural, social and formal science.

However, the applied nature of the research objective, with its pragmatic conceptual framework focused on a problem in the world, is unbounded by a single disciplinary boundary. Pragmatically this suggests an inter-disciplinary approach is required to gain the best result (perhaps bordering on trans-disciplinary) (Greckhamer, Koro-Ljungberg, Cilesiz, & Hayes, 2008; G. Jones, 2007; Kinzig, 2001; Kline, 1995; McNeill, 1999; Redclift, 1998)[12].

Summarizing, in this thesis:

"Key Theoretical Frames" consist of knowledge determined to be most practically relevant to the problem and solution domains implied by the research objective.

These are collectively labelled "K0". They are identified in this chapter, and explored in increasing levels of detail in Chapter 4 and 7.

The literature related to the chosen epistemological approach (design science) argues that knowledge from many "reference disciplines" or "kernel theories" are required to undertake such research. This inspired the above conceptualization of key theoretical frames (see commentary to Figure 3-6 for detail).

[12] This is biased by the training in inter- and trans-disciplinarity, the core bias of my graduate program.

3.2.3.4 Comparator Knowledge (K1…n)

Attempting to rigorously generate knowledge through the solving of a practical problem clearly requires relevant knowledge; the key theoretical frames introduced above. However, continuing to use the terminology colloquially for the time being, when designing a solution what knowledge determines the utility of the solution? In other words what knowledge is used in the process of evaluation?

If the same knowledge is used to evaluate utility as was used to understand the problem and design the solution all that is demonstrated is the internal consistency of the solution – not it's utility in solving the problem. Internal consistency is not the same as practical utility[13].

So where can researchers locate knowledge which evaluates utility? That the designer of a solution may not be the user of the solution points to a resolution. Solution users have tacit and explicit knowledge gained through experience that is separate from the explicit knowledge in key theoretical frames[14]. This then is an alternative source of knowledge to key theoretical frames. Gathering this knowledge and using it to determine solution utility is the focus of evaluation. Contrast this to the focus of the build activity stream: the application of key theoretical knowledge to understanding the problem and creating the artefact (maximally internally consistent) solution.

Summarizing, in this thesis:

> "Comparator Knowledge" informs solution utility and comes from the user's experience of the solution in light of their tacit and explicit knowledge.
>
> Each source of comparator knowledge is given a label: "K1", "K2", "Kn". Sources of comparator knowledge are identified in this chapter. They are explored and the methods / techniques used for their collection described in detail in Chapter 6.

[13] However, assuming the rationality of the solution designer, maximizing the internal consistency would typically be a goal for any solution.

[14]Some of this knowledge may be based on the key theoretical frames, but it is mediated by the users' learning and experience, formal and informal, and not the learning and experience of the solution designer.

3.2.3.5 Risks to Validity of Knowledge from Inter-Disciplinary Research

The disciplinary approach has (implicit) limits to its exploration of problems in the world. This is due to the internal consistency of the key theoretical frames which are necessarily imposed on knowledge produced within each discipline.

On the other hand the literature on inter- and trans-disciplinarity identifies a similar, although different (implicit) limit: to be able to bring relevant key theoretical frames from multiple disciplines to bear on a problem in the world presents a challenge to the internal consistency of the knowledge produced (Assimakopoulos, Theocharopoulos, & Dimitriou, 2007; Bobrowsky & Rickman, 2007; Greckhamer et al., 2008; F. Handy & Bunch, 2009; G. Jones, 2007; Kinzig, 2001; Klein, 2004; Knights & Willmott, 1997; Massey et al., 2006; McNeill, 1999; Redclift, 1998).

Colloquially this is often known as the issue of depth (from disciplinarity) vs. breadth (required in inter- / trans-disciplinarity): Any research which attempts to use the theory and method (and hence the underlying ontological and epistemological assumptions) from multiple disciplines risks either:

1. Running into challenges based on the a priori incommensurability between disciplines, or
2. Entirely missing relevant knowledge from one or more disciplines.

The intention of inter- / trans-disciplinarity is to surmount this challenge. However, limits to human cognition, time and resources require researchers to make practical choices. The result: the number of key theoretical frames to be explicitly considered and the depth to which they can be understood in any one piece of inter-disciplinary research must be limited.

These challenges of inter- and trans-disciplinary research suggest risks to the validity of the knowledge produced by such research. As per the critical tradition, reflecting upon these risks identifies that pragmatics will drive both the depth and breadth of both theoretical knowledge which can be brought to bear and comparator knowledge that can be gathered during this research.

This leads to the identification of three specific risks to the validity of the knowledge produced by this research:

1. Utility will be reduced due to ‘missed’ theoretical knowledge and that this will only be discovered during evaluation based on the comparator knowledge collected.
2. Utility will be reduced due to ‘missed’ theoretical knowledge and that this will be discovered during evaluation due to the failure to gather the required comparator knowledge.
3. Aspects of utility will be left unevaluated due to failure to gather the required comparator knowledge, and that this will **not** be discovered.

In this research it is acknowledged that these risks are not removed, but attempts to mitigate them are made. This is accomplished by the thoroughness of the research design and the attempt to follow it.

3.2.4 Research Design Scaffold

The above has established a scaffold for the design of this research (summarized in Figure 3-3 below):

- The research objective is the overall context for this research and answers the question: what is the intended use for a model of sustainable business (i.e. what problem is it to solve)?
- The conceptual framework identifies the key choices for the research design along with the researcher’s biases based on the objective. For this research these are:
  - A purpose to explore to solve a problem in the world, i.e. an applied axiology
  - A critical pragmatic philosophical bias
  - A realist epistemology
- Within this conceptual framework the research objective requires

– The creation (via preparation, build evaluate and communicate activity streams) of a model of sustainable business

– The identification of relevant key theoretical frames (K0) from the natural, social and formal sciences to aid understanding of the model of sustainable business problem and solution domains.

– A search for and application of comparator knowledge (K1..n) from users of the model of sustainable business to enable the utility of the model to be determined.

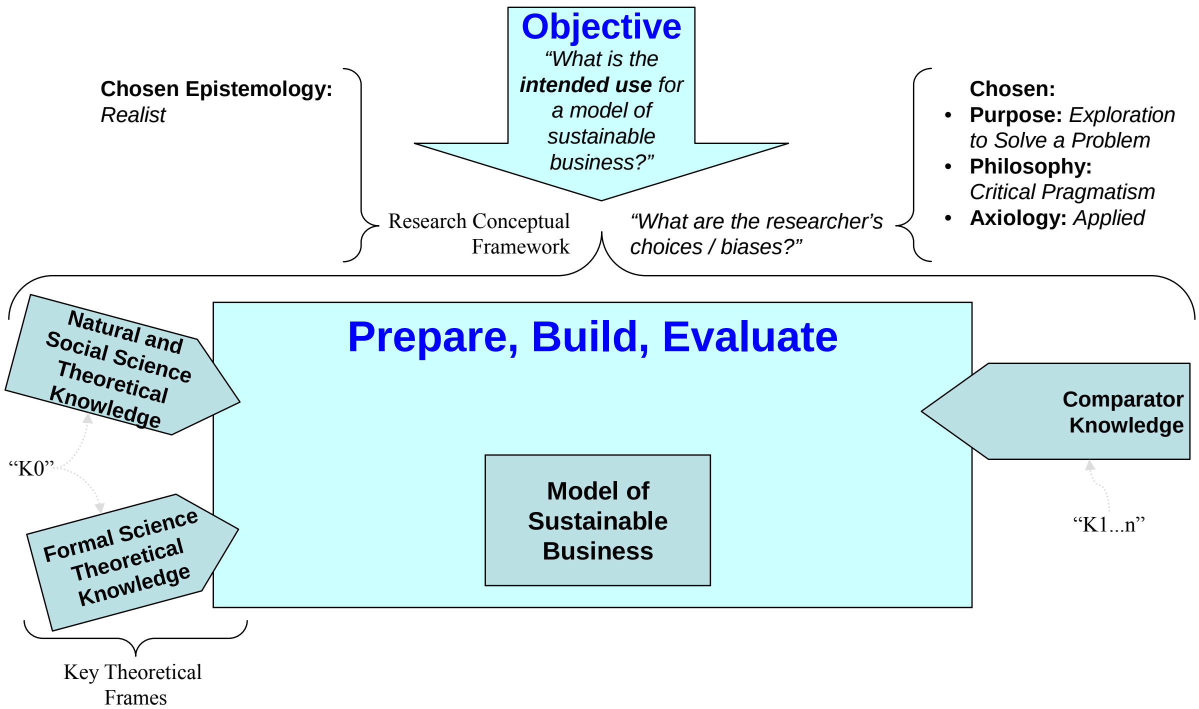


Figure 3-3: Overall Research Design Scaffold – Zeroth Pass

In the remainder of this chapter this scaffold is elaborated to produce the final overall research design. This overall research design is further developed into the detailed research design in the following three chapters (4, 5 and 6: one each for Prepare, Build and Evaluate respectively)

3.3 Epistemological Possibilities

3.3.1 Introduction

The critical pragmatic bias of this research leads to an epistemological question:

What epistemological approaches will best meet the research objective?

Once again the three steps are used to answer this question (Search, Reflect, Apply).

This section searches the literature for advice relevant to the research objective, reflects on this advice and concludes by identifying a clarifying question. The following section searches the literature relevant to the above question, reflects on this advice and applies it to create the overall research design.

3.3.2 An Introduction to the Literature

Natural science warnings of the impact of failing to solve the widely recognized interconnected and complex problems facing humanity have been growing for over 50 years (as just one recent example see Rockström, 2009). The social science disciplinary response to these warnings has largely been, in their best traditions, to continue to produce new knowledge via descriptive scientific approaches – the discovery and justification of theories based on existing phenomena. While clearly necessary, it is unclear if this overall approach is sufficient to generate the type and quantity of new knowledge within timeframes that might allow humanity to avoid the worst effects of the Global Problématique (Ozbekhan, 1970).

The choices and behaviours of businesses, and human organizations generally, are a key contributor to our current "mess" (Ackoff, 1981a, p.23; Ackoff, 2004; Alpaslan, 2011, pp.15-54). But it is also clear that human's will need to continue to create organizations to solve any problem outside the capabilities of a single individual (Ouchi, 1980). Hence it becomes critical to quickly understand how these same organizations can be structured so as to, at a minimum not add to the mess, and at best contribute to its resolution[15].

A broad context for our mess is the now widely recognized idea that the economy is wholly contained by and entirely inter-dependent with society and that in turn society is wholly contained by and dependent upon the biosphere (aka the "natural" environment) (Crutzen, 2002; Marcus et al., 2010, Fig.1; Porritt, 2007, p.57; Victor, 2008, Fig.2.2). Organizations, while socially constructed, interact with all three of these contexts at the same time and over time.

This perspective suggests that to be useful to managers, to enable them avoid adding to or to better contribute to the resolution of the Global Problématique, the new knowledge they require must be grounded in and integrate across these three contexts, i.e. theoretical knowledge from the natural, social and formal sciences is required and must be integrated in ways which is actionable by managers (Marcus et al., 2010, p.429).

The typical descriptive scientific approach to knowledge production involves creation and testing of theories through the examination of existing phenomena in-situ or in the laboratory, observed using disciplinary lenses (Braa & Vidgen, 1999). These lenses are honed via analysis: asking in ever more detail what are the parts from which the phenomena arose.

A generally accepted theoretical definition of the sustainable organization does not currently exist (1.3.2). Why might this be so? One reason is that the phenomena of the sustainable organization, based on the above natural science, does not currently exist to be studied; perhaps at best some components are starting to emerge (as but one illustration: Pagell & Wu, 2009). Another reason: the disciplinary descriptive science approach makes it difficult to produce the necessary integrated knowledge (Marcus et al., 2010). In turn this makes it hard for managers to apply this knowledge to solve the many practical problems involved in

[15] This is a personal value which I hold to be true. In designing this research it is a key normative assumption that has been integrated with the identified key theoretical frames to create the research outputs. Hence, if the reader finds this work of value, this research is an example of many of the key points made concerning the value of design science in the creation of legitimate new knowledge related to organizational sustainability.

organizational sustainability, since these seldom fit within disciplinary boundaries. A clear 'catch-22' for disciplinary descriptive science.

From the perspective of understanding the overall process of human inquiry and problem solving none of these observations should be surprising. Paraphrasing Einstein: we can not solve our current problems using the knowledge and techniques which created them – i.e. the historically 'normal' single disciplinary lens remains necessary but will not be sufficient: inter-and trans-disciplinary synthesis is also required – i.e. design and systems thinking.

3.3.3 Epistemological Possibilities: A Clarifying Question

Reflecting on these challenges (the requirement for new approaches, coupled with the urgency of the need for information which managers can use to avoid adding to or better contribute to the resolution of the mess), motivated the following clarifying question.

> Are there alternative methods of knowledge production, complementary to descriptive science, which could increase the speed of generating legitimate knowledge that could be applied by managers to avoid worsening or to help resolve the Global Problématique?

The remainder of this chapter provides an answer, through the step-wise development and justification of the overall research design.

3.4 Design Science to the Rescue?

Experience and background knowledge suggest that a proven answer to the clarifying epistemological question was design science. Based on this suggestion, this section searches the relevant literature, reflects on the advice found and applies it to this research.

3.4.1 What is Design Science?

Simon, in the work widely regarded as the initiator of design science, states that schools of

> *"engineering, medicine, business, architecture and painting are concerned not with the necessary but with the contingent – not with how things are but with how they might be – in short, with design"* (Simon, 1996, first published 1969, p. xii).

Figure 3-4 shows one situation of design within a range of types of research.

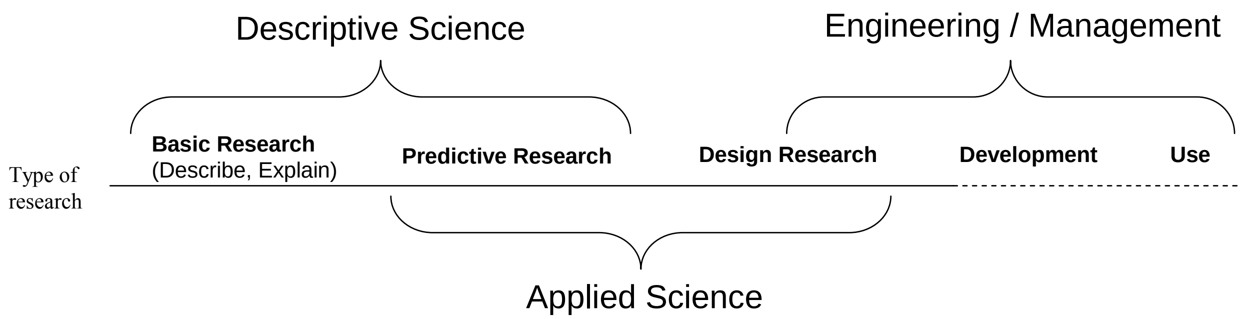


Figure 3-4: Design as a Scientific Method[16]
(Adapted from Patokorpi & Ahvenainen, 2009, Fig.1 p.128)

Reviewing the history of design research, Bayazit stated that:

> *Design research is a systematic search and acquisition of knowledge related to design [of useful things] and the design activity* (Bayazit, 2004, p.16)

Writing from the perspective of two management disciplines, Hevner (in a seminal article about design in the Management Information Systems field) and Bullinger (in her PhD thesis about design in the Innovation / Strategy field) offer the following definitions. Design science:

> *Creates and evaluates […] artefacts intended to solve indentified organizational problems* (Hevner, March, Park, & Ram, 2004, p.77).

> *Strive[s] to solve problems by an action-oriented approach, in order to find a viable artefact* (Bullinger, 2008, p.216).

Ackoff, writing over 20 years earlier and from the Operations Management disciplinary perspective, defined "the design approach" as "a synthesis of the clinical and research

[16] Design as a science (i.e. an epistemology; an approach to knowledge production) is strongly related to, but is not to be confused with the science of design – i.e. the scientifically valid descriptive, explanatory and predictive knowledge of how best to undertake the design activity which may be undertaken as part of any of type of research including descriptive or design science – see footnote 3 for an example of the latter.

approaches" – i.e. a synthesis of an action oriented approach to problem understanding and solution, and descriptive science analysis of the parts of a problem so that their interconnections are minimal and relatively independent (Ackoff, 1981a).

Writing on the process and output of design science research Hevner states:

> *Design is both a process (set of activities) and a product (artefact) – a verb and a noun. It describes the world as acted upon (processes) and the world as sensed (artefacts). This platonic view of design supports a problem solving paradigm that continuously shifts perspective between design processes and designed artefacts for the same complex problem. The design process is a sequence of expert activities [i.e. the science of design,] that produces an innovative product, i.e. the designed artefact. The evaluation of the artefact then provides feedback information and a better understanding of the problem in order to improve both the quality of the product and the design process. This build-and-evaluate loop is typically iterated a number of times before the final design artefact is generated. During this creative process, the design-science researcher must be cognizant of evolving both the design process and the design artefact as part of the research.* (Hevner et al., 2004, p.78)

Writing in his Innovation / Strategy PhD[17] on the definition of the term "problem" in the design science context Al Debei states:

> *The term "problem" can be defined as the existence of a gap between the current situation (or state-of-the-world) and the desired situation […]. The magnitude of the problem can be determined by the size of the gap or the difference between the current and desired states. The gap […] represents the problem space which is either fulfilled or at least shrunk by the introduction of the [solution, the] designed artefact.* (Al-debei, 2010, p.32)

Within these definitions, an artefact is taken to mean a physical or conceptual object that the researcher (aka the designer) is suggesting may have utility in the solution of a problem. The

[17] Al-Debei lists 13 works published or pending publication based on his PhD, including scholarly journal articles, conference papers and book chapters.

design science approach consists of the creation of such objects followed by a structured evaluation of the object's utility against its intended purpose, i.e. does it practically help solve the problem.

In light of the objective of this research the above framing of design as applied research, related to practical problems, appears highly sympathetic.

Summarizing, in the context of the objective of this research:

> Design science creates knowledge based on the experience gained from the rigorous construction and evaluation of artefacts, using the best available knowledge, that are useful to managers solving problems.

3.4.2 Design Science and Descriptive Science Compared

As the then editor of MISQuarterly, the pre-eminent journal in the Management Information Systems field, in 2000 Lee discussed the relationship of design and descriptive science in a presentation to the 11th International Conference on Information Management (ICIM). More recently, in 2003 Romme, a researcher in the Innovation, Technology Entrepreneurship and Marketing fields[18], presented a comparison of design and descriptive science at the 4th Conference on Organizational Learning, Knowledge and Capabilities (OLKC). Table 3-3 synthesizes these two comparisons.

[18] Romme's home page: https://venus.tue.nl/ep-cgi/ep_detail.opl?taal=US&fac_id=98&voor_org_id=&rn=20052251 states he is known as a "pioneer who brought the design sciences to organization studies".

	Research Activity	**Tendency**	**Purpose**	**Output**	**Examples**
Descriptive Science Inquiry	Describing and explaining the bio-physical and social	Theoretical	**Truth**: the description / explanation / theory is true	Theory[19] & Evidence	Physics, Chemistry, Biology, Ecology, Sociology, Economics, Psychology
Design Science Inquiry	Building and evaluating something new	Applied	**Efficacy**: the built artefact is useful	Artefacts & Evidence	Engineering, Medicine, Architecture, Law, Management, Information Systems

Table 3-3: Design and Descriptive Science Modes of Knowledge Production
(Derived from:Lee, 2000, Slides 15-16 speakers notes; Romme, 2003b, Table 1 & 2)

Other researchers have also contrasted the descriptive and design approaches from different perspectives.

Relating to the processes of creating an artefact to solve a problem and descriptive science, both March and Smith and Hevner et. al. suggest that "each new artefact created […] is an experiment that poses a question to nature […]. Existing knowledge is used where appropriate; however, often the requisite knowledge is nonexistent [… hence…] reliance on creativity and trial-and-error search are characteristic of such research efforts", i.e. abduction is key (Hevner et al., 2004, p.81; March & Smith, 1995, p.258).

Comparing the importance of novelty in design and descriptive science Bullinger citing Brooks states: "in design, in contrast with [descriptive] science, novelty itself has no merit […] we test [our artefacts] by their usefulness and their costs, not their novelty" (Bullinger, 2008, p.216).

[19] Note that Theories and Artefacts are both credentialed knowledge, but the process of credentialing is different.

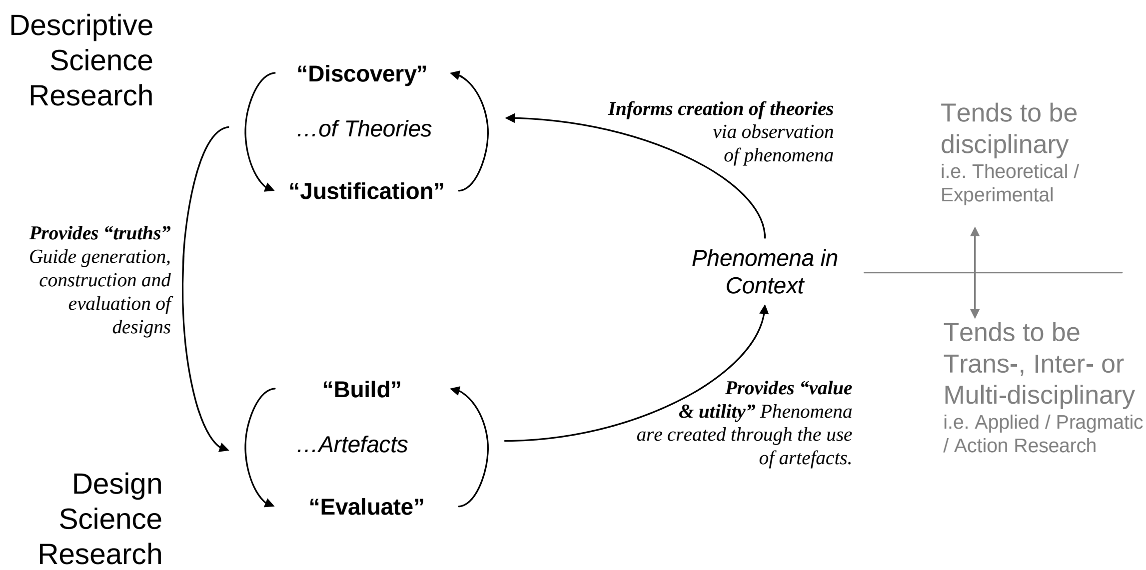


Figure 3-5: Design Science and Descriptive Science – A Causal Loop Diagram[20]
(Derived from text of March & Vogus, 2010)[21]

To conclude on the connection between descriptive and design science, Figure 3-5 illustrates March and Vogus's (2010, pp.196-198) summary of a range of management literature from 1973-2008. From their review they state that descriptive science and design science "represent a virtuous cycle in management research with results of [descriptive] scientific inquiry being reformulated into (preliminary) design propositions and the results of design inquiry being reformulated into hypothesis that can be tested [via descriptive science]". They go on to highlight that "the relevancy and value [of descriptive science theory] are determined by the degree to which they enable managers to design business systems that improve organizational performance" and that answering questions such as 'what systems will yield improved performance?' are "fundamentally a design task that requires shaping artefacts and events to create an envisioned, more desired future".

Hence as shown in Figure 3-5 descriptive science and design science are highly complementary approaches to knowledge production related to management and

[20] Summary of Causal Loop Diagramming (CLD) technique: www.pegasuscom.com/cld.html For many examples the application of CLD to organizations and organizational change see Senge et. al. (1999).
[21] Subsequently others have graphically characterized the relationship between design and descriptive science using this same basic loop (Hevner, 2011, Slide 7)

organizations. Descriptive science theorizes about what is[22]; design science uses those truths and normative goals to create phenomena in the world. In turn these phenomena can be subject to further study by descriptive science.

3.4.3 Why is Design Science Applicable to Management?

Perhaps, as per Simon, it would be better to ask, why design science is not applicable to management:

> *Everyone designs who devises courses of action aimed at changing existing situations into preferred ones.* (Simon, 1996, first published 1969, p.130)

Managers are primarily engaged in solving problems to create preferred outcomes. According to Simon this implies managers are primarily engaged in processes of design. As an applied discipline, the study of management and organizations has the intention of creating knowledge to help managers and their organizations better solve problems, i.e. outcomes count, not whether the solution is based on known theory.

As Lee has noted, using examples of the experience of Johannes Kepler and Sardi Carnot[23], problems in the world, including those in the applied academic fields of medicine, architecture and law, are frequently solved well in advance of descriptive scientific truths (theories) being available (Lee, 2000, Slide 16 + speakers notes). Hevner makes the same point “An artefact may have utility because of some as yet undiscovered truth” (Hevner et al., 2004, p.80).

Hevner (2004, p.81) and Al Debei (Al-debei, 2010, p.32) discuss the nature of the problems to which design science can be best applied. These authors, summarizing others, suggest that design science is particularly suited to many problems in management, since these can be best understood as “wicked”; i.e. the problems:

- Have unstable and unstructured requirements and constraints based on ill-defined contexts.

[22] Considering what is as reality (essentialist) or “reality” (anti-functionalist).
[23] As described in Kuhn’s seminal “Structure of Scientific Revolutions”

- Have complex interactions between parts and wholes in the problem and solution.
- Include the inherent possibility to dynamically re-imagine contexts that in turn can change design processes and artefacts (i.e. the design process and design artefact may need to evolve during the research process in order to best understand the problem and create the most viable solutions).
- Require human cognition to understand the problem and create viable solutions (e.g. creativity permeated by potentially conflicting idealized goals derived from stakeholders' world-views / value-systems).
- Require human social processes to understand the problem and create viable solutions (e.g. social interaction between stakeholders of the problem and its solution is required).

Gharajedaghi, one of Ackoff's PhD students and a long time research collaborator, summarizing the conclusions he and his supervisor had reached on a life-time's experience solving wicked problems through the application of design practices to social systems, stated:

> *We strongly believe that a participative design process is the most effective way to produce a desirable change in the behavioural pattern of a social system. This pretentious (daring) optimism, however, is based on the following assumptions:*
>
> 1. *"The future is not contained in the past; much of it is yet to be written."* (Ackoff, 1981b)
> 2. *The best way to learn and understand a system is to redesign [change] it.*
> 3. *People are more likely to accept an idea when they have had a hand in shaping it.*
> 4. *Performance of a system is essentially design-driven. An order of magnitude improvement requires a redesign.*
> 5. *"With unfeasible parts, one can create a feasible whole."* (Ackoff, 1981b)

6. *Opposing tendencies form an "and" not "or" relationship. Both win/win as well as lose/lose are strong possibilities.*

(Gharajedaghi, 2006, p.125)

Meadows, writing in 1993 but published posthumously, agreed, stating:

The future can not be predicted, but it can be envisioned and brought lovingly into being. [Social] systems cannot be controlled but can be designed and redesigned. (Meadows & Wright, 2008, p.169)

All this suggests that it would be advisable to spend at least some energy considering how best to enable managers to take the knowledge produced by descriptive science management and organizational research (mode 1 knowledge production) and utilize it in their design (problem solving) processes. This is the realm of design science and hence this research (mode 2 knowledge production).

In addition to exploring the distinctions and complementarities between mode 1 and mode 2 knowledge production, Van Aken (2005) also reviews the literature to support the validity and complementary benefits of adding design science to the portfolio of research methods used by management and organization scholars.

In doing so she joins a number of other scholars who have recently supported the earlier observations of Simon and Ackoff: scholars and managers using design science may gain additional benefits compared with the current majority of management and organizational scholars using only descriptive science. This is a result of the improved problem solving processes and improved solutions that may arise from the design science approach (Au, 2001; Ball, 2001; Dunbar & Starbuck, 2006; Hevner & Chatterjee, 2010c; Holmström, Ketokivi, & Hameri, 2009; Holmström & Romme, 2011; Johansson & Woodilla, 2009; March & Smith, 1995; Mohrman, Gibson, & Mohrman, 2001; Romme, 2003b; van Aken, 2004; Van Aken & Romme, 2009).

3.4.4 Who is Undertaking Design Science Research?

While the design science applied research paradigm emerged in the 1960's (Bayazit, 2004; Cross, 2006; Simon, 1996, first published 1969) it is slowly being applied to a wide range of social and management scientific research (March & Vogus, 2010; Van Aken & Romme, 2009). A further review of the literature leads to this list of examples by sub-discipline:

- Business (Martin, 2009)
- Management (Boland & Collopy, 2004b)
- Strategy and Innovation (Al-debei, 2010; Bullinger, 2008; Osterwalder, 2004a), as well as
  - The special issue of Business Strategy and the Environment vol. 14 no. 5 (Dobers & Strannegård, 2005)
  - The special issue of Journal of Business Strategy vo. 28, no. 4 "Design and Business: Why Can not We Be Friends" (Martin, 2007)
- Industrial engineering (Rajala & Väyrynen, 2011)
- Operations management (McLaren & Buijs, 2011; McLaren, Head, Yuan, & Chan, 2011)
- Organization (Romme, 2003a), as well as the special issues of Organizational Studies vol. 29 no. 3 and Organization Science vol 17, no. 2.
- Management Information Systems (MIS) (Al-debei, 2010; Hevner, 2011; Osterwalder, 2004a), as well as the special issues of MIS Quarterly vol 32, no. 4 and the European Journal of Information Systems v17, no. 5. Fischer, in a recent review of MIS design science literature reported 50 design science articles in the top six MIS journals from 2007-2010 (Fischer, 2011), while in their editorial to the special issue of Information Systems and E-Business Management, Gregor and Hevner were able to report "the rigorous application of design science… is growing rapidly and producing exciting results" (Gregor & Hevner, 2011).

3.4.5 But is Design Science “Science”?

Design is an activity which occurs in many problem solving contexts, creating different tangible and/or intangible artefacts in each: product designers creating new physical artefacts, consultants creating organizational solutions, public servants creating new policies and scientists creating experiments are just a few examples. All of these activities may lead to new phenomena that can be studied by descriptive science.

So what is different about research that uses design as its epistemology? What legitimates the knowledge produced in design science research over artefacts produced in other design activities? What credentials are required for the research output to be considered a legitimate contribution to knowledge (Venable, 2006, p.9)?

Before reporting on the literature’s response to this challenge, it is worth noting that descriptive science has the same challenge. Hypothesis are proposed and tested in all kinds of contexts, the resulting knowledge is not all credentialed as legitimately scientific. Certain other conditions and tests must be passed; hence we should expect this to be also true for other modes of research such as design.

As Table 3-4 shows some design science researchers have gone further than others in defining what constitutes legitimate design science research.

Research Attribute Suggested to Convey Legitimacy*	(Hevner et al., 2004)	(Venable, 2006)	(Baskerville, 2008)	(Winter, 2008)
1. Design as an Artefact	Design-science research must produce an innovative purposeful (viable) artefact in the form of a construct, a model, a method, and/or an instantiation.	Newness of knowledge produced (contribution cv. knowledge use) Type of knowledge produced		
2. Problem Relevance	The objective of design-science research is to develop an innovative purposeful artefact for a specified problem domain	Relevance (to a community) – complete enough to guide practitioner decision making and add to the formal knowledge base for subsequent testing by other researchers.		High quality design science, like behavioural research, must be relevant (i.e. useful to the community – academic and practitioner)
3. Design Evaluation	Because the artefact is purposeful, it must yield utility (including quality and efficacy) for the specified problem, i.e. a design artefact must be rigorously demonstrated via well-executed evaluation methods.			Depth and degree of researcher reflection [upon] and guidance of artefact evaluation
4. Research Contributions	Since the artefact must be innovative, novelty is crucial (solving a heretofore unsolved problem, or solving a known problem in a more effective or efficient manner), effective design-science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.	Newness of knowledge produced (contribution cv. knowledge use) Generalizability of knowledge produced (new solution to how to solve a class of problems cv. Solution to a single situated problem)		Problem solutions are generic to some extent, i.e. applicable to a set of problem situations
5. Research Rigor	The artefact itself must be rigorously defined, formally represented, coherent, and		Systemic – As a science, design science has to with the systemic creation of knowledge about, and	High quality design science, like behavioural research, must be rigorously conducted.

Research Attribute Suggested to Convey Legitimacy*	(Hevner et al., 2004)	(Venable, 2006)	(Baskerville, 2008)	(Winter, 2008)
	internally consistent. Design-science research relies upon the application of rigorous methods in terms of construction and evaluation of the artefact.		with, design. It includes the creation, via interventions to solve problems, of designed artefacts, through the application of design theory and methodology.	
6. Design as a Search Process	The process by which it is created, and often the artefact itself, incorporates or enables a search process whereby a problem space is constructed and a mechanism posed or enacted to find an effective solution. The search for an effective artefact requires utilizing available means to reach desired ends and satisfy laws in the environment.			Depth and degree of researcher reflection [upon] and guidance of artefact construction
7. Research Communication	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.			

Table 3-4: Attributes Conveying Legitimacy for Design Science Research Outputs

*(Framework suggested by Hevner et al., 2004, Table 1 p.83 and Description pp.82-90. Copyright © 2004, Regents of the University of Minnesota. Used with permission).

Writing in a seminal information systems design science research article, Hevner specifically addresses how is design research different from routine design:

> *One issue that must be addressed in design science research is differentiating routine design or system building from design research. The difference is in the nature of the problems and solutions. Routine design is the application of existing knowledge to organizational problems, such as constructing a financial or marketing information system using best practice artefacts (constructs, models, methods, and instantiations) existing in the knowledge base. On the other hand, design-science research addresses important unsolved problems in unique or innovative ways or solved problems in more effective or efficient ways. The key differentiator between routine design and design research is the clear identification of a contribution to the archival knowledge base of foundations and methodologies.* (Hevner et al., 2004, p.81)

In a 2011 presentation Hevner elaborated, stating that legitimate design science research can be separated from routine design if it results in:

> *Inspiration: develop new solutions for known problems*
>
> *Invention: new solutions for new problems, [or]*
>
> *Exaptation – extend known solutions to new problems.* (Hevner, 2011, slides 24-29)

Summarizing, there appears to be broad agreement that legitimate design science research gives rise to credentialed knowledge if it includes, at a minimum, the creation of an artefact that:

- Solves a relevant problem in a novel and generic manner,
- Is built, evaluated and communicated in a rigorous and systemic manner by a reflective researcher.

As expected, as a scientific research approach, design science continues to develop these definitions, attempting to codify them in research methodologies to formalize the process of legitimate knowledge creation (Gregor & Jones, 2007; Hevner, 2007; Iivari, 2007; Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007; Venable, 2006).

3.4.6 Applicability of Design Science to Organizational Sustainability Research

Earlier the critical problem of organizational sustainability was identified, along with one potential solution: our need to significantly increase the rate of legitimate knowledge production usable by managers. Further it was established that in the absence of sustainable organizations, phenomena do not exist from which descriptive science can undertake comprehensive theory building. In turn, such theory building would necessarily be within disciplinary bounds and hence would be unlikely to integrate and synthesize knowledge about the biosphere, society and the economy in ways actionable by managers.

Finally the proceeding established that the design science approach can produce legitimate new knowledge in advance of phenomenon existing by the creative synthesis of existing sources of legitimate knowledge across all disciplines through the application of normative goals, i.e. design science:

1. Has an *explicit* normative component
2. Attempts to create useful knowledge despite *incomplete* descriptive science knowledge

It would therefore appear that design science, due to its different constraints to knowledge production compared with descriptive science, could be a good complementary candidate to help create the knowledge to solve the critical challenge of building and realizing sustainable organizations (Dobers & Strannegård, 2005).

To confirm this finding, a further search of the literature was undertaken, focused using two questions:

Why may the design science epistemology be particularly relevant to organizational sustainability research given that it:

1. Has an *explicit* normative component?
2. Attempts to create useful knowledge despite *incomplete* descriptive science knowledge?

The answers to these two questions, found during this addition search of the literature, are presented under the following two headings.

3.4.6.1 The Value of the Normative to Organizational Sustainability Research.

There is little sense that a consensus definition of sustainability will be quickly, if ever, reached[24]. A quick review of labels used to describe research in this space gives a sense of the lack of consensus: sustainable development, sustainable consumption, corporate social responsibility, shared value creation, responsible business, triple bottom line, weak sustainability, strong sustainability, social entrepreneurship, green, natural capitalism, flourishing, socially responsive. As a further specific example: in a 2008 collection of articles about sustainable consumption (sic) the editors found it necessary to devote 30 pages to the topic of "sustainability: a multi-interpretable notion: this book's normative stance" as part of their introduction (Tukker, Chater, Vezzoli, Stø, & Andersen, 2008, pp.14-44).

A small number of researchers have started to examine why this might be so. Their conclusions suggest that descriptive social science may face additional barriers to being able to create some types of knowledge related to social and organizational sustainability.

In their important interdisciplinary work[25] "Supply Side Sustainability" Allen and Hoekstra (1999; 2003, p.23, p.199 & p.381) and the more recent work by Tainter (2003; 2006) concluded that sustainability was paradoxically the result of "the interplay between a continuously evolving state of nature and a continuously changing state of mind" (i.e. based on human values which are always evolving), and not "a [static] ecological condition". This perspective indicates that sustainability, as a goal to be achieved in the future, will never have a unitary definition for all persons at any point in time, let alone over time. Further, as a result of this mutable definition its archievement will only be measureable retrospectively based on the prevailing world-views at the time of measurement.

[24] This research's use of the sustainability in the organizational context is introduced in 3.5.3 and subsequently defined and justified in Chapter 4.

[25] Between them the authors include a biologist, an ecologist, a sociologist and a historian who had been working together for approximately 10 years at the point these works were published. As the authors note, such a close long term working relationship is one of the few ways that increase the possibility for creating valid inter-disciplinary knowledge despite the a priori incommensurability between their respective disciplines.

Another author who has understood sustainability in a similarly paradoxical light is one of the founders of the field of Industrial Ecology, MIT scholar, John Ehrenfeld. He suggests, in a very positive way, that there should be a new collective goal for humanity which he labels "sustainability", defined as "The possibility that human and other life will flourish on this planet forever" (Ehrenfeld, 2008, p.6).

Ignoring the thermodynamically impossibility of "forever", this definition challenges humanity to set its goals high and for the long term; not to be satisfied to merely scrabble and scrape on a rat race of survival. Instead Ehrenfeld challenges humanity to humbly use its understanding (albeit incomplete) to set an audacious stretch goal for current and future generations: a goal of flourishing; proactively choosing to attempt to maximize happiness now and in the future (Upward, 2012a).

These perspectives on the definition of sustainability, where mutable and variable human values are a key part its definition, implies that any organization striving to improve its future sustainability must by definition consider future ideal goals[26]. Since these goals cannot be known through inductive and deductive analytical techniques, abduction is required for useful knowledge to be generated.

As but one practical example: Ray Anderson former CEO of Interface Inc., described his experience in 1993 of reading Paul Hawken's "The Ecology of Commerce" (2010, first published 1993) as "a spear in my chest". He went on to comment that he realized he now "stood convicted as a plunderer of the earth" and that in the future "people like me will go to jail" (Kinkead, 1999). Anderson did not use induction or deduction when he came to this conclusion; rather he was abducting about how people in the future would judge him based on the changed set of personal values reading the book had caused him to adopt. He was

[26] Economists, perhaps starting with Adam Smith, have long noted the importance of human values in understanding future (economic) outcomes. Smith's idea of the "invisible hand", that individual self interested behaviour would inevitably lead to collective benefit, was always assumed by Smith to be constrained by those individuals' ethical and moral "sympathy" for their fellow humans. i.e. Individuals would choose not to act in ways that would harm the collective good even if it would benefit them individually because their values, in Smith's case based on belief in a Christian God, would tell them that such actions would be considered morally wrong. Smith set out these ideas in his earlier work, one he considered more important than The Wealth of Nations, The Theory of Moral Sentiments, 1795 (J. A. Brown & Forster, 2012; C. B. Handy, 1994, p.10; Stevens, 2011, pp.6-8).

clearly not using current human values and societal norms, he was abducting that future humans would adopt values similar to those espoused by Hawkin. Putting this belief into action, in 1995 Anderson put in place his company's sustainability strategy (since 2003 called "Mission Zero"). This strategy was based on his new values that anticipated how future generations would view the currently socially normalized values and consequent acceptable behaviours. The world-leading initiatives that flow from the Mission Zero strategy are materially changing the behaviours of Interface. In turn this is changing, based on the anticipated future state of the biosphere and societal values, the monetary, social and environmental sustainability of Interface's outcomes.

Building on these themes, in his recent work Doppelt (2012) has made an early attempt to identify the normative individual and collective values that might enable individual and collective behaviours compatible with greater conservation and enhancement of the biosphere and increased levels of human happiness over those typically achieved in the Global North today. These aspirational values can be of assistance to design science researchers as they consider what normative values might be most appropriate when designing artefacts with utility to solving the problems of organizational sustainability.

Reflecting on the complexity and mutability of the context to and problems of defining and achieving organizational sustainability, problems in this field of inquiry warrant the use of the label "wicked" (from the earlier definition 3.4.3).

Based on this introduction the key theoretical frames required to explore organizational sustainability in the context of the research objective are identified (3.5.3.1), explored in detail in chapter 4 and applied to the designed artefact and its evaluation in Chapters 7-9.

3.4.6.2 The Challenge of Incomplete Knowledge to Organizational Sustainability Research

Today we have incomplete descriptive science knowledge of what might constitute a sustainable biosphere, society, economy and organizations (1.3.2). With the suggested labelling of the current geological era as the Anthropocene (Crutzen, 2002), natural scientists are indicating that the biosphere will continue to change – albeit now primarily driven by human behaviour. Further we have a wide range of individual and collective values[27] about what sustainability means which guides our current individual and collective actions. The work illustrated by Rockström, et. al., Allen, et. al., Anderson, Doppelt, Brown and Macy suggest that tomorrow all these elements, our knowledge, the state of biosphere and our values, will be different – perhaps significantly.

Given the permanently mutating definition of sustainability, design science, when applied to the “wicked” problems of organizational sustainability, has the conceptual advantage of not looking for ultimate truths. March and Vogus (2010, p.204), summarizing Simon (1996, first published 1969, p.141), state that a science of design would be “rooted in (1) utility and statistical decision theory to define ‘the problem space’ and (2) optimization and ‘satisficing’ techniques to search it”. Hence design science research which applies such a ‘science of design’ can make contributions to knowledge and advance understanding even when, as with organizational sustainability, many absolute truths appear to be theoretically impossible to identify due to the permanent mutability of the concept of sustainability.

3.4.7 Rigor in Design Science Organizational Research Methods

A challenge to the use of design science approaches for organizational research recalls the literature’s advice on legitimacy. This challenge centres on how to ensure sufficient rigor in the process of undertaking organizational research using the design science approach to ensure the highest degree of legitimacy for the knowledge produced.

As noted in the introduction to this part: all design is about choice, and it is the designer who must make those choices in order to complete any design. Hence at some point abductive thinking and judgment must enter any process of design.

Of course, any such judgments should be treated with scepticism in the scientific context of a thesis which aims to be academically valid. In general organizational design science researchers have recognized this challenge and papers providing methodological guidelines for maximizing rigor have and continue to be produced (Brank, Grobelnik, & Mladenić, 2005; Cleven, Gubler, & Huner, 2009; Gregor & Jones, 2007; Hevner et al., 2004; Hevner &

[27] Inappropriate as Doppelt and others have suggested (M. Brown & Macy, 2004).

Chatterjee, 2010a; Hevner, 2011; Iivari, 2007; Kuechler & Vaishnavi, 2008; March & Smith, 1995; Vaishnavi & Kuechler, 2009; Venable, 2010).

Searching this body of organizational design science methodological literature, this sub-section looks specifically at how to ensure rigor in the methods used in and hence legitimacy of outputs from organizational design science research. This search is focused using the following question:

How should researcher's best maximize rigour in design science organizational research?

As noted in the introduction to this Part, it is this body of methodological advice that recommends the researcher be as transparent and explicit as possible about their judgments (the world-view / value systems which drive them) and their justification.

3.4.7.1 Research Framework in Information Technology

In an important[28] article by March and Smith (1995, p.255) relates the activities of information systems research and the outputs from such research required for rigour and hence legitimacy. This advice has been subsequently updated to include an additional output now commonly accepted by information systems researchers (Vaishnavi & Kuechler, 2009, p.6). Table 3-5 integrates these authors advice.

The research activities are unsurprising based on the earlier review of design and descriptive science and the strong up take of design science in the information systems field (3.4.4).

However the identification of the details of the research outputs in this research is helpful. March and Smith state constructs, models, instantiations and method are possible components of artefacts produced by design science research. They also note that method can be an output from the design science approach (as opposed to an element of the artefact produced).

[28] Google Scholar report 1122 citations as of November 24, 2011

		Research Activity Streams			
	Output Elements	**D. Build (Develop / Design)**	**E. Evaluate (Validate)**	**T. Theorize**	**J. Justify**
Possible Research Output	i. Constructs				
	ii. Models				
	iii. Instantiations				
	iv. Method				
	v. Better Theories				

Table 3-5: A Research Framework in Information Technology
(March & Smith, 1995, p.255; With additions from Vaishnavi & Kuechler, 2009, p.6)

March and Smith suggest that to be rigorous design science research should attempt to create artefacts that contain the first four outputs – although this might be achieved through many individual research projects conducted over a considerable period of time[29].

Summarizing March and Smith (1995, pp.256-258):

> ***Constructs*** *or concepts [are] the vocabulary of a domain. They constitute a conceptualization used to describe problems within the domain and specify their solutions.*
>
> *A* ***model*** *is a set of propositions or statements expressing relationships among constructs. […] Models represent situations as problem and solution statements*[30] *[…and are] valuable in so far as [they] are useful [… hence] certain inaccuracies and abstractions are inconsequential for [the defined] purposes. [… However,]*

[29] An idea picked up by Hevner when he proposed the information systems research framework 9 years later; see 3.4.7.2 below

[30] As a specific example of a modelling formalism in Information Systems design science research March and Smith refer to Entity Relationship Modelling. This, along with Osterwalder's use of this formalism influenced its use in this research. See Chapter 5 for details.

unless the inaccuracies and abstractions inherent in models are understood, their use can lead to inappropriate actions.

An ***instantiation*** *is the realization of an artefact in its environment. […] Instantiations [may] operationalize constructs, models and methods. […] Instantiations demonstrate feasibility and effectiveness [i.e. utility] of the models […] they contain.*

A ***method*** *is a set of steps […] used to perform a task. Methods are based on constructs and a model.*

Al Debei (2010, p.34) summarized Kuechler and Vaishnavi's contribution (Kuechler & Vaishnavi, 2008; Vaishnavi & Kuechler, 2009) that added better theories to the possible research outputs of design science research. Al Debei suggested that better theories may consist of:

Better operational theory*. Theories about the construction and development of […] design artefacts*

Better solution theory*. Theories about solution spaces and theories related to goal artefact[s].*

3.4.7.2 Information Systems Research Framework

The same article in which Hevner et. al. provided the attributes that convey legitimacy in design science research (introduced in Table 3-4: Attributes Conveying Legitimacy for Design Science Research Outputs) also provided a process perspective on information systems research. They refer to this process perspective as the "Information Systems Research Framework" and use it illustrate how information systems research may include both the descriptive and design science approaches.

As shown in Figure 3-6, the sequence in which these authors suggest the information systems research process unfolds is:

First a. Define the problem and b. Determine the applicable knowledge

Second, iteratively (possibly in one project, or in multiple projects over time) a. Develop / build theories or artefacts, and b. Justify the theories or evaluate the artefacts.

Third: a. Apply the research output to solve problems in the environment and/or b. Add to the knowledge base.

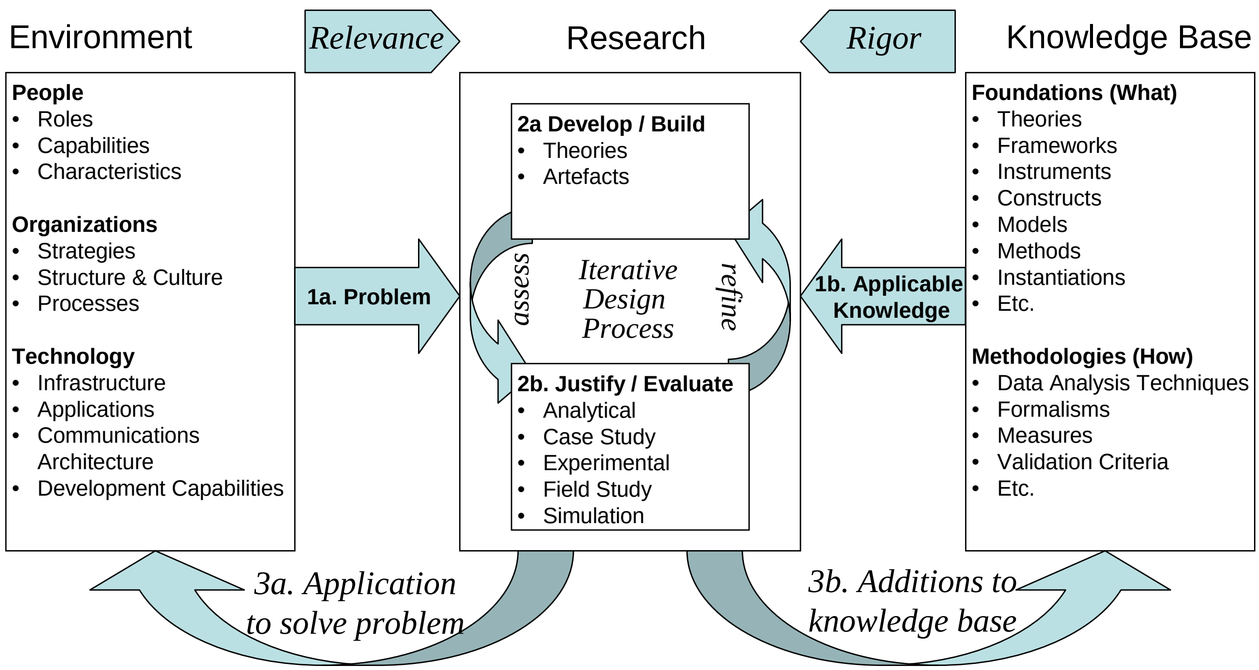


Figure 3-6: Information Systems Research Framework
(Hevner et al., 2004, Fig.2 p.80. Copyright © 2004, Regents of the University of Minnesota. Used with permission)

Hevner et. al. note that the knowledge base from which applicable knowledge is drawn comes from many “reference disciplines”. These “provide foundational theories, frameworks, instruments, constructs, models, methods, and instantiations used in the develop/build phase of a research study, and methodologies to provide guidelines in the justify/evaluate phase”. They go on to state that “rigor is achieved by appropriately applying existing foundations and methodologies" to each research activity (Hevner et al., 2004, p.76). Kuechler and Vaishnavi also claim the importance to design science rigor of knowledge drawn from outside the information systems field, referring to such knowledge as "kernel theories" (Kuechler & Vaishnavi, 2008)[31].

Al-Debei, summarizing the advice from several scholars, notes that such key theoretical frames are normally originated outside the information systems field [and that] such theories could be useful as they may suggest helpful approaches to information design problems" (Al-debei, 2010, p.35).

Recently Hevner in a presentation accompanying the launch of his 2010 monograph "Design Research in Information Systems" (Hevner & Chatterjee, 2010a) helpfully labelled the cycling through 1a and 3a as the "relevance cycle" and the cycling through 1b and 3b as the "rigor cycle" (Hevner, 2011, Slide 12).

3.4.7.3 The Research Cycle for Conducting Design Science Research

Kuechler and Vaishnavi also provide a "research cycle" which suggests how Hevner et. al.'s framework can also be turned into a rigorous process for design science inquiry (aka a task oriented project plan). Their research cycle shows prototypical but more specific tasks for the researcher to undertake compared to Hevner et. al.'s framework (Kuechler & Vaishnavi, 2008, p.493).

[31] These ideas inspired the need to identify the"key theoretical frames" in this research. Key theoretical frames are conceptually identical to Hevner et. al.'s "reference disciplines" and Kuechler's "kernel theories".

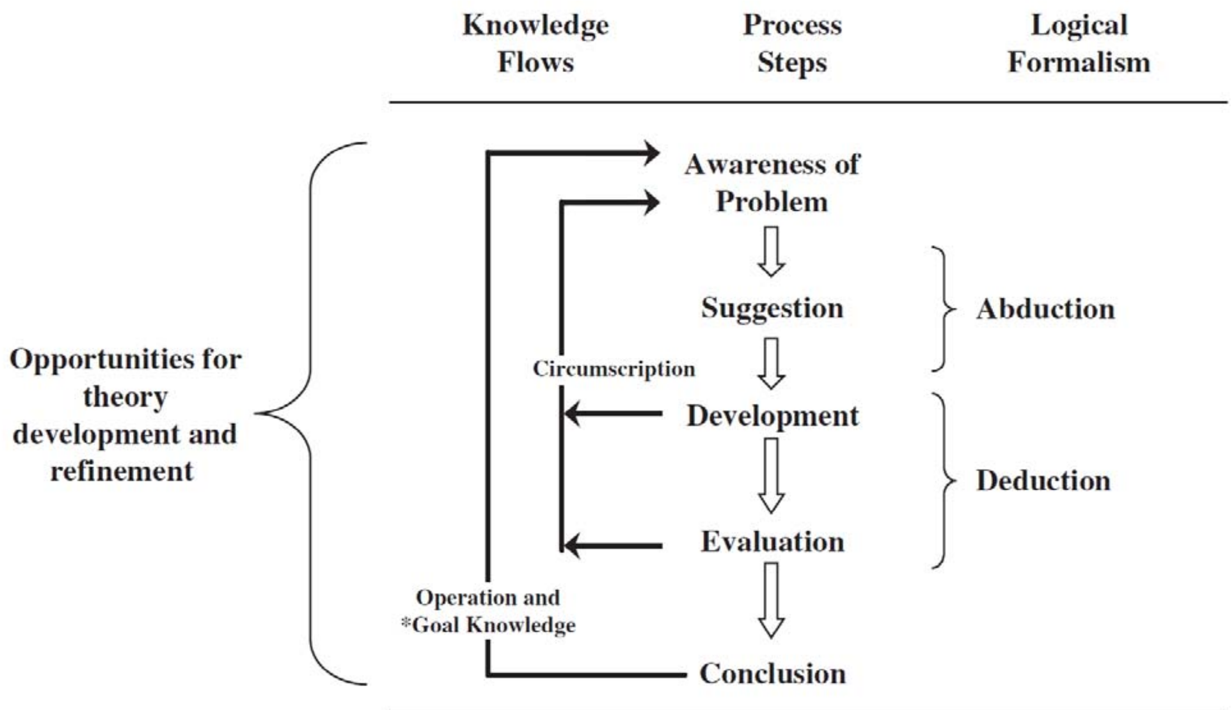


Figure 3-7: Design Science Research Cycle
(Kuechler & Vaishnavi, 2008, Fig.3 p.493. Reproduced with permission of Palgrave Macmillian. This material may not be copied or reproduiced without permission of Palgrave Macmillian)

The process steps (activities) in this research cycle align well with the overall research framework described by Hevner et. al. in their framework. Specifically:

- “Defining the problem” (1a) and “Determining the applicable knowledge” (1b) map to “Awareness of problem”.
- “Develop/Build” activities (2a) maps to “Suggestion” and “Development”.
- “Justify/Evaluate” activities (2b) maps to “Evaluation.
- “Apply Research Outputs to Solve Problem” (3a) and “Add to Knowledge Base” activities (3b) map to “Conclusion”.

3.4.8 Validity of Design as a Science

Reflecting on this search of the literature related to design science suggests that the applicability of design science to (organizational) sustainability research such as this appears to be both valid today, and likely valid in the future. This is because our desire to achieve benefits for humans and humanity remains constant whilst new knowledge continues to be created and the state of the biosphere and our values continue to change (Dobers & Strannegård, 2005; Kruijsen, 1998; Melville, 2010; Patokorpi & Ahvenainen, 2009; Polaine, 2011, pp.48-50; Venable, Pries-Heje, Bunker, & Russo, 2010).

In this regard design science is perhaps unique amongst research methods, since it requires the researcher to generate knowledge by satisficing: synthesizing current truths revealed by descriptive science with ideals based on our current values (making both explicit in the process).

3.4.8.1 Design Science A Rescuer, Yes! The Only Rescuer, No!

This review is **not** concluding that design science is a panacea for organizational sustainability research. To be clear:

1. Some researchers may find that progress in helping society and organizations solve what many consider to be the critical problem of our time can be made using a design science approach. Design science depends in very large measure on a store of legitimate knowledge that only descriptive science can produce.

2. Researchers looking for new organizational sustainability best practice phenomena to study as a basis for theory building might find more useful examples appearing more quickly if more design science research was conducted to help apply earlier theoretical knowledge and (future oriented) societal goals.

This review merely suggests that perhaps descriptive science researchers might wish to encourage colleagues to increase the speed of new phenomena creation, phenomena grounded in existing credentialed knowledge, by adopting a design science approach. This research provides such an example and hence it is hoped this research is seen as legitimate and deserving of the support of the academy.

It is worth noting that in the field of Information Systems, based on the 1995 call to arms by March and Smith (1995), this advice is being actively followed (see 3.4.4), albeit in a field currently felt to be in decline (Hirschheim & Klein, 2011).

3.4.9 Applying Design Science to Creation of a Model of Sustainable Business

The above completes the search literature related to design science in the organizational research context. Reflecting overall, given the objective of this research, design science is chosen to be the epistemological approach.

To guide a more detailed reflection on this literature and to apply the results to this research design a new question is:

> How to best apply (operationalize) the design science epistemology given the research objective?

Based on the literature searched above this question is answered under this heading resulting in the first pass of the overall research design (summarized in Figure 3-8 below), and is built on the scaffold introduced earlier (3.2.4 summarized in Figure 3-3):

- The design science literature suggests that four activity streams are required: prepare, build, evaluate and communicate. Of these prepare, build and evaluate are separate in time, with prepare preceding build, and evaluation following build.
- Prepare identifies the key theoretical frames (K0) relevant to the research objective by answering the question "what could a model of sustainable business consist of?"
- Build takes the key relevant theoretical frames (K0) to analyze (using abduction, induction and deduction) the problem and solution domains in order to answer the question: "what should the model of sustainable business consist of?
- Building results in the creation of the model of sustainable business – the designed artefact from this research.

- Evaluation compares this artefact with comparator knowledge (K1…n) relevant to determining the utility of the artefact based on the research objective, answering the question: "Is the model of sustainable business useful?"
- The research concludes with the creation of an evaluated model of sustainable business and ideas for its improvement based on the feedback gathered.
- Communication of the knowledge gained goes on during and continues after the other activity streams (not shown in the figure).

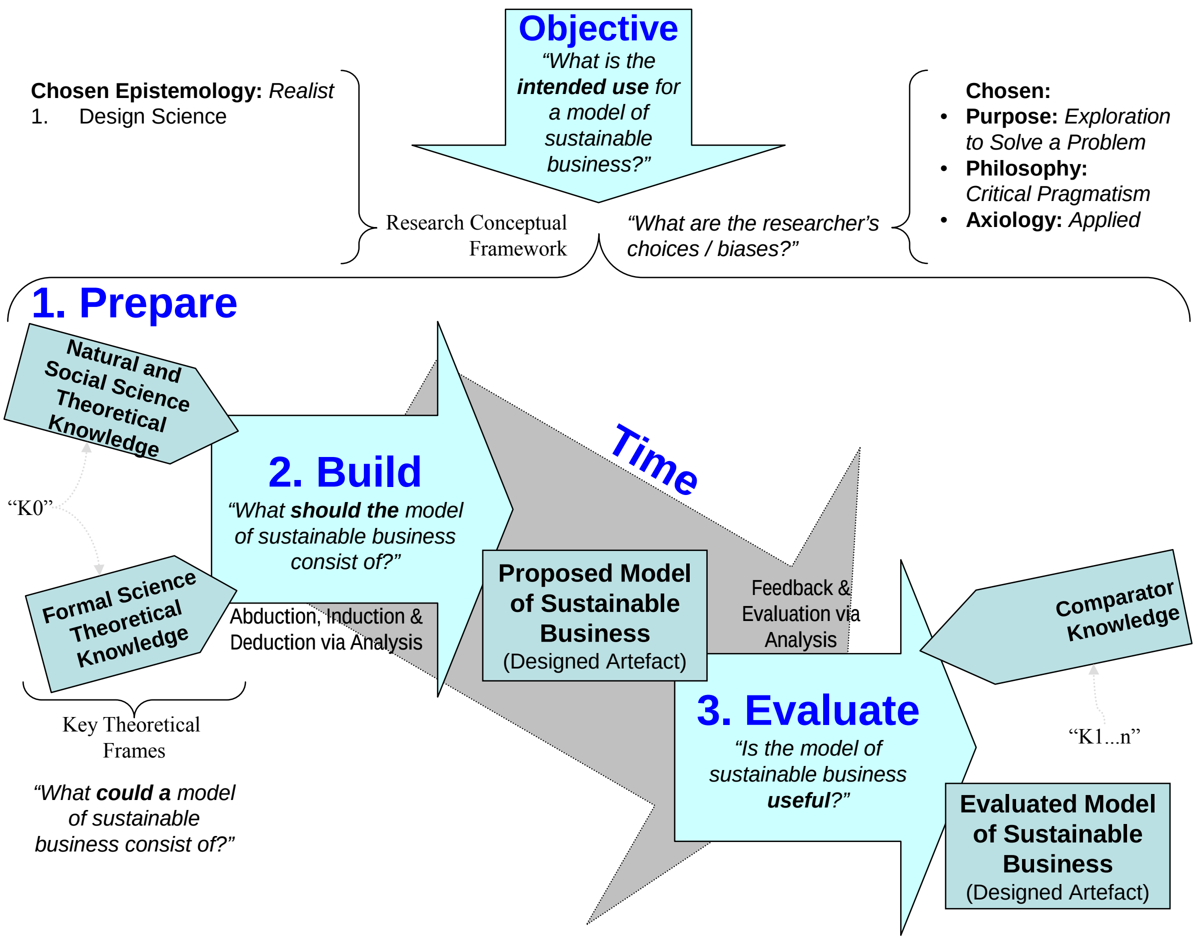


Figure 3-8: Overall Research Design – First Pass

3.4.9.1 Meeting the Research Objective and Testing the Working Hypotheses

Recalling the overall objective for this research (2.2) and the working hypotheses (2.4): the rationale for choosing, and the choice of the design science epistemology for this research is the first evidence presented suggesting that the research question can be answered in the affirmative and that working hypotheses are confirmed.

3.4.9.2 Support of Overall Best Practice for Achieving Rigor

As noted in the introduction to this part: the above body of methodological advice supports the recommendation that rigor is best achieved through explicit presentation of the researcher's choices, judgments (the world-view / value systems which drive those choices) and justifications.

3.5 Challenges Designing Design Science Organizational Sustainability Research

The search of the literature which led to the choice of design science for this research also identified significant challenges applying this approach to the objective of this research: helping managers improve the sustainability of their organization.

This is partly due to the novelty of this approach to research. Having completed a similar review of research using the design science epistemology, a recent design science researcher noted in his 2010 PhD, "the scheme to construct […] artefacts in information systems design-science research is still very broad" (Al-debei, 2010, p.35).

Hence, before concluding on the overall research design, a further exploration of the problem and solution domains and the question of maximizing research rigor is indicated.

This section introduces and resolves, based on the research objective, two challenges identified in the literature for the effective use of design science in organizational sustainability research. These two challenges were synthesized from the review of the literature above.

Given the research objective:

> **Challenge One:** How to determine what artefact this research will build – i.e. an artefact with high utility to managers looking to solve organizational sustainability problems?
>
> **Challenge Two:** How to ensure rigour in this organizational sustainability design science research and hence the legitimacy of its designed artefact?

This section once again applies the three steps introduced at the start of this part. For each of the two challenges: searches of the literature relevant to these questions are undertaken. Then, using the results, reflections on and application to this research design are presented.

The following section (3.6) concludes this chapter and summarizes the final overall research design.

3.5.1 Challenge One: Artefacts With High Utility to Managers?

The first challenge centres on ensuring the overall goal of an applied research project is met. As an applied researcher one is ultimately aiming to equip managers with useful knowledge (often embedded in tools) to solve their organization's sustainability challenges.

But there is nothing in the design science paradigm that advises the researcher on the nature of the artefacts that have the highest utility for managers. In this case:

> Which artefacts are most useful to managers when solving organizational sustainability problems?

3.5.1.1 Attributes of High Utility

To be able to identify the nature of artefacts that might have high utility to managers in helping them solve organizational sustainability problems attributes of artefacts that would be suggestive of their high utility in this problem domain need to be identified.

Five attributes, whose fulfillment by an artefact might lead it to have high utility in this problem domain, were identified from the literature:

Attribute 0: Use of the artefact in design based problem solving.

Manager's messy / wicked organizational challenges have been observed to be more tractable using design approaches (Ackoff, 1981a, pp.90-97; Martin, 2009, p.24). As established earlier, attempting to define and then change an organization so that it creates the conditions for sustainable outcomes to emerge is such a problem (3.4.3). Hence artefacts that help managers design solutions to their specific organizational sustainability problems will have high utility in this problem space.

Attribute 1: Encapsulate constructs related to facts and values.

As established earlier: understanding sustainability requires facts and human values (0). Hence an artefact will have high utility in the organizational sustainability problem domain if it is able to encapsulate both facts and values.

Attribute 2: Encapsulate a synthesis of constructs from the multiple disciplines involved in organizational sustainability (concepts and their inter-relationships).

As established earlier: solving problems related to sustainability requires the use of knowledge from multiple disciplines (3.3). Hence an artefact will have high utility in the organizational sustainability problem domain if it is able to encapsulate a synthesis of constructs and their inter-relationships from multiple fields of human knowledge.

Attribute 3: Aid in communicating the encapsulated concepts and their relationships to users of the artefact.

An artefact that makes accessible its encapsulated knowledge with the least amount of effort to its users (i.e. problem solving managers) has higher utility than one which does not. Further, in this communication an artefact that does not require its users to first adopt the value system or world-view of the artefact's designer increases the likelihood that users will engage (at differing levels) with the artefact, i.e. high utility results if the artefact does not prescriptively communicate its encapsulated knowledge and values. This is important for artefacts related to organizational sustainability, where as noted earlier (3.4.6.1), the user's values will not necessarily align with the artefact's designer, but yet will play an overriding role in the use of the artefact in the user's problem solving process.

Attribute 4: Encapsulatability in tools to support efficient and effective scaling of the use of the artefact.

An artefact which is either directly, or may be encapsulated in, a tool is a well tried method for scaling the practical application of knowledge (Boland & Collopy, 2004a, p.11). Given the urgency of the organizational sustainability problem, artefacts in this problem space will have high utility if they are or can easily be turned into tools that are straight forward and attractive for large numbers of managers to use.

3.5.1.2 Understanding Utility

Design science researchers have identified that utility may be understood to consider an artefact's: completeness, quality and beauty (Cleven et al., 2009; Hevner et al., 2004; March & Smith, 1995). Table 3-6 explores how these three aspects of utility map to the identified attributes of an artefact with high utility in the organizational sustainability problem space.

Table 3-6 along with the literature cited, can be used by researchers as a starting point for designing the evaluation activity stream of organizational sustainability design science research[32].

[32] Chapter 6, the detailed design of the evaluation activity stream, shows how this advice was applied in this research.

Aspect of Utility / Attributes of Artefact with High Utility	Completeness	Quality	Beauty
0. Use of the artefact in design based problem solving.	✓	✓	✓
1. Encapsulate constructs related to facts and values.	✓		
2. Encapsulate a synthesis of constructs from multiple disciplines	✓		
3. Aid in communicating the encapsulated concepts and their relationships to users		✓	✓
4. Encapsulatability in tools		✓	✓

Table 3-6: Aspects of Utility and Identified Attributes of an Artefact with High Utility to the Organizational Sustainability Problem Domain

3.5.1.3 Ontology: An Artefact with High Utility for Mangers Solving Organizational Sustainability Problems

So far this section has identified, as suggested by the literature, the attributes of artefacts that will increase their utility to managers solving organizational sustainability problems.

Reviewing the literature with these attributes and this definition of utility in mind one artefact recommended itself: the ontology. Ontologies are in wide spread use as artefacts of design science research that is situated within the key theoretical frames identified. Further, ontologies appear to have high scores on each of the attributes of utility to managers in the organizational sustainability problem domain.

Using the now familiar three step process, under this heading, the literature related to ontologies will be searched, reflected upon for its applicability given the research objective, and subsequently applied to the research design. This results in the second pass of the overall research design (3.5.1.5).

Brief History of Ontologies and Their Creation

Writing in her Innovation and Strategy design science PhD, whose artefact was an ontology for the innovation process in organizations, Bullinger states, citing others, that:

Aristotle characterized ontology [a branch of metaphysics] as the doctrine of being, regarding 'all the species of being qua being and the attributes which belong to it qua being'. It was his aim to create definitions which explained what a thing is by being a statement of the essence of the entity. This essence is thought to be objective and thus independent of human cognition.

The difficulties to find answers to ontological questions primarily lie in the problem of perception [. Hesse states that the problem is that '…] our perception of the reality is filtered by our perception organs, [thus] we cannot be sure that the world is constituted as we experience it'.

It is a particularity of ontological philosophy that [, as Hesse puts it '...] the answer must inevitably be given by linguistic methods […].'

Consequently, modern ontological approaches in analytical philosophy focus on the importance of language and ontology capture is based on language analysis (Bullinger, 2008, pp.134-142)

Ontologies as artefacts were originally conceived in the field of artificial intelligence (AI) in the late 1960's. AI researchers needed a way to formally express problem domain knowledge in software in order to enable the possibility that reasoning might occur. (Gruber, 1993). As Bullinger notes, this implies that for these researchers there is no longer one way of being – only ways that are useful.

AI researchers did this by designing structures to contain the set of knowledge relevant to the topic the AI was to reason with; this knowledge can be based on multiple (possibly contradictory) world-views / value systems[33].

By 1982 Grochla and Gillner were working on what now would likely be referred to as an "enterprise ontology" (i.e. an ontology in the domain of business but oriented to management and organizational information systems design rather than overall business design) (O'Leary, 2010).

Despite their increasingly wide spread use by Information Systems (computational) researchers, these researchers did not give these engineering artefacts a consistent name! Summarizing their use Bullinger states that they "are widely used for different purposes (e.g. natural language processing, knowledge management, the Semantic Web etc.) and by diverse communities (e.g. knowledge engineering or Artificial Intelligence) [and hence] definitions of the [engineering artefact] are nearly as numerous as there are […] initiatives" (Bullinger, 2008, pp.134-142).

The term ontology (a noun) was subsequently defined by Gruber (1993). The diverse community undertaking this type of research now generally refers to the engineering artefacts they produce as ontologies. At about the same time ontology engineering was coined as the name of the field focusing of the creation of such engineering artefacts.

With the 2008 publication of the "Handbook of Ontologies for Business Interaction" (Rittgen, 2008), it is clear ontologies were in use as the design science artefact of choice in management research within the key theoretical frames identified for this research (Innovation, Strategy, Operations Management and Management Information Systems).

[33] Personal communication with Schulich Prof. Henry Kim Schulich School of Business, York University, whose PhD involved adding a domain-ontology for quality management based on the ISO 9000 quality management standard to the existing Toronto Virtual Enterprise ontology (TOVE). Face-to-face discussion Dec 7, 2011.

Of particular importance, given the research objective, is the ontology of Alexander Osterwalder – the Business Model Ontology (BMO). This is introduced in this chapter and explored in increasing detail in Chapters 4 and 7. For now it is sufficient to note that:

- This work is directly relevant to the research objective and hence is considered part of the 'truths' contained in the identified key theoretical frames.
- This work has been evaluated through both academic and significant on-going practitioner work, leading to significant face validity.
- Preparing a critique of this work was a key early step in achieving the objective of this research.

Writing recently one management ontological researcher was able to state:

Ontology research is of growing interest in information systems. In this context, ontologies are recognised as useful means for achieving semantic interoperability between different [human and digital] systems. This is because ontologies [use language to] capture semantics of information systems to facilitate shared understanding between different parties. Moreover, the importance of ontologies comes from the fact that they are considered important backbones [in] many organisational applications (Al-debei, 2010, p.18).

Definition of Ontologies

Building on the works of Gruber (1993, p.199) and Guarino (1998, p.9) recently Bullinger has stated that

An ontology is defined as an artefact that gives an explicit partial account of a shared conceptualization (Bullinger, 2008, p.142).

The word explicit implies formal, rigorous and structured. The word partial is used to indicate that an ontology is a designed conceptual artefact, and therefore has all the advantages and disadvantages of any other abstract model of reality. The word shared means it utility comes from social agreement of its partial account.

Purpose of Ontologies

Reviewing the purpose of an ontology, Bullinger states:

An ontology is used as a framework which helps to enable communication between people, between people and systems, and between systems: a lingua-franca.

Ontologies disambiguate and provide a consensual conceptual vocabulary, on which one can build descriptions and communication acts (p.148).

Hence more than one person must agree to the proposed ontology for it to be useful.

In a 2009 Information Systems monograph "Handbook on Ontologies" an article by Guarino opens the work, answering the question "what is an ontology". This article's definition of and purpose for ontologies is aligned with the above and in additional discusses how ontologies may be applied in the computational context (Guarino, Oberle, & Staab, 2009).

Generic Benefits of Ontologies

Osterwalder selected an ontology as the designed artefact for his 2004 Management Information Systems, Strategy and Innovation centred PhD. That year Osterwalder helped to organize a management information systems / e-Commerce conference workshop whose title embedded a statement of their benefit "conceptual business models and ontologies to improve the design and inter-operability of the networked enterprise"[34] (Osterwalder, Gordijn, & Bouwman, 2004).

As another benefit, Osterwalder implicitly asserts, based on the definition of an ontology of a providing a "consensual conceptual vocabulary" (Bullinger, 2008, p.142) that it is possible to have one normative ontology for all types and sizes of

[34] The word network is used in reference to one of the implications for business of the internet – the move from value chains and value systems (M. E. Porter, 1985) to business webs (Tapscott, 2000) or networks (Kagermann, Lay, & Moore, 2008).

firms (although Osterwalder's work focuses on the hot topic at the time of writing – eBusiness). Other researchers in the field of business ontologies implicitly align with this assertion (Al-debei, 2010; Bullinger, 2008).

Writing four years later Bullinger was able, based on her review of the literature, to summarize the benefits of generic ontologies in the "field of business administration" (Bullinger, 2008, pp.142-161):

1. **Overcoming language barriers** between departments within organizations to enable improved understanding (person-to-person and when mediated by digital systems), i.e. A "lingua franca for the relevant part of reality".

2. **Enabling co-ordination** of collaborative actors inside and outside the organization to enable improved action (person-to-person and when mediated by digital systems).

Types of Ontologies

That a diversity of use might require some differentiation in the nature of ontologies and that each might be best suited for particular (computational) purposes was explored by Guarino (1998).

Osterwalder reported ten application areas for ontologies. These includes four that were organizationally oriented: enterprise integration, standardization of product knowledge, electronic commerce and legal information systems (Osterwalder, 2004a, p.2).

He went onto identify a large number of widely used "reference models", such as SCOR (Supply Chain Council, 2005; 2008;) which he characterized, along with his "Business Model Ontology" (BMO) artefact as "domain ontologies" (Osterwalder, 2004a, p.2).

Other of successful domain ontologies include the Telecom Industry Specific eTOM[35], and "Reference Models for Industrial Enterprises" (Scheer, 1994, that helped inspire SAP's Business Maps and Deloitte's Industry Prints) as well the more academically oriented MIT Process Handbook (Carr, 1999; Malone, Crowston, Lee, & Pentland, 1999; Malone, Crowston, & Herman, 2003), the Edinburgh Enterprise Ontology (Uschold, King, Moralee, & Zorgios, 1998) and the Toronto Virtual Enterprise (TOVE) (Fox, 1992).

Osterwalder characterized such domain ontologies as things "which one can be referred to as an authority" stating that as such they "provide a pattern" on which a problem solving manager can base a solution to their specific problem. Based on their embedded knowledge he suggested that such domain ontologies have, through their widespread proven advantages to managers: improving the efficiency of the processes to understand problems and create resolution (Osterwalder, 2004a, p.2).

Writing 4 years later Bullinger devotes a chapter to her review of ontologies "deployment in business" (Bullinger, 2008, pp.142-161). This included a number of examples which intersect with those above. She categorized her examples as follows: "ontologies used for the representation of enterprises, ontologies supporting e-business and [those] used to support management processes".

Writing at the same time as Bullinger, Andersson et. al. were attempting to synthesize three business model domain ontologies, including Osterwalder's, into what they identified as a "reference ontology". These authors observed that "ontologies are viewed as an increasingly important tool for structuring domains of interest" and that their reference ontology for business models would identify "opportunities to complement and improve" business model ontologies (Andersson et al., 2006).

Based on her review of the literature Bullinger provides a typology of ontologies as artefacts:

[35] Telemanagement Forum (http://www.tmforum.org/)

An ontology can be classified anywhere on the continuum between a highly specific application ontology to a most general representation ontology, depending on the usage scenario the ontology is intended for. It can be realized with any degree of formality between natural language and predicate calculus; if an informal or semi-formal ontology is developed, it has to be done in a way which allows for future formalization. Expressiveness of the ontology might be lightweighted or heavyweighted, depending on the application (Bullinger, 2008, pp.142-161).

She also states that "there is nothing which obliges an ontologist to use a formal language if the intended application does not claim it" (Bullinger, 2008, pp.142-161). In this vein Osterwalder observed that the language he developed to express his business model ontology is "self defined semi-formal" (Osterwalder, 2004a, p.3).

All this is supported in the summary of ontology content and types provided by O'Leary is his review of a number of enterprise ontologies (discussed below) (O'Leary, 2010)

Parts of an Ontology

Ontologies are not monatomic, they are a whole that contains parts based on a world-view or views which provides an organizational logic – i.e. the world-view provides an intentional semantic structure (Guarino, 1998; Uschold & Gruninger, 1996). The information systems ontology literature, summarized by Bullinger, suggests that these parts are structured using a taxonomy based on this organizational logic (a logical theory). Such a taxonomy contains classes, relationship and axioms (Bullinger, 2008, pp.142-161) .

Proximity of Design Science and Ontology Engineering

So far the search and reflection on the management and organizational ontology literature suggests that ontologies are potentially an artefact with high utility given the research objective.

However, the selection of the design science epistemology, suggests it is also important to understand how the methods of ontological engineering relate the chosen design science epistemology.

Do ontology engineering methods complement, add to, or detract from achieving rigour within a design science epistemology?

As noted, in recent years the approaches, methods and techniques for rigorously constructing ontologies have come to be known as ontology engineering (Akkermans & Gordijn, 2006; Al-debei & Fitzgerald, 2009; Sure, Staab, & Studer, 2009; Uschold & King, 1995; Uschold & Gruninger, 1996) and have spawned a journal to record the fields contribution (The Journal of Applied Ontology).

The complementary proximity of design science and ontology engineering is shown by their common notions of conceptualization. Design science artefacts are suggested to consist of at least constructs and a model which relates them (Table 3-5). Ontology engineering artefacts are suggested to consist of classes and the relationships between them). Further, both approaches explicitly require the evaluation of the designed artefact.

However, there are differences, most notably: "the inclusion of *solutions* [italics in the original] in design science which is not relevant to modeling an ontology" (Bullinger, 2008, p.221, footnote 245).

Indeed some ontological engineers have identified weaknesses in their field's traditional methods which the design science approach can help to remedy (Akkermans & Gordijn, 2006; Al-debei & Fitzgerald, 2009), although other ontological engineers remain uninterested in the design science perspective on methods of artefact construction and evaluation (Sure et al., 2009).

Exemplar Organizational Ontologies

Prior to the 2000's only a very few researchers had undertaken organizational and management design science explicitly considering an ontology as the designed artefact.

The unique example found "An Ontological Design Methodology for Organizational Structure and Processes" was presented at a conference workshop and published in the subsequent proceedings[36], but never published in a journal (P. H. Jones & Christakis, 1999)[37].

However, as mentioned earlier (3.4.4), since 2004, a number of scholars have completed, defended and made an impact with design science research in the organization and management field using the ontology as their chosen artefact and design science as their primary epistemology.

Table 3-7 summarizes the reasons all these exemplar researchers chose an ontology as their designed artefact compared to the high utility attributes introduced in 3.5.1.1.

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[36] Originally published as: Jones, P.H. and Dye, K.M.C. (2000). A methodology and system for designing organizational ontologies: Using knowledge-based tools for constructing organizational knowledge. *First International Workshop on Theory and Applications of Knowledge Management, TAKMA 2000*.

[37] This work also has an interesting epistemological synthesis which remains unusual but inspiring given the objective of this research: its authors explicitly take a systemic approach to their understanding of organizations and management, to the research design process, the artefact design process ***and*** the design of the artefact.

The attempt at total integration of systems and design thinking (aka systemic design science) make this work the closest antecedent found to this research – albeit one which is primarily focused on monetary organizational sustainability (although considerable concern is shown for the social aspects of organizational sustainability).

At this point in this chapter we are only part way to the establishment of a similar integrated systems and design approach in this sustainable business model research design. It is mentioned here as it is the earliest work on organization and management ontologies found. Its approach lends some credibility to the direction being developed for the design of this research.

Attributes of Artefact with High Utility \ Researcher	(Osterwalder, 2004a, p.22)	(Bullinger, 2008, pp.160-161)	(Al-debei, 2010, pp.17-19)	(O'Leary, 2010, p.337)
0. Use of the artefact in design based problem solving.	✓	✓	✓	✓
1. Encapsulate constructs related to facts and values.				
2. Encapsulate a synthesis of constructs from multiple disciplines			✓	
3. Aid in communicating the encapsulated concepts and their relationships to users	✓	✓	✓	✓
4. Encapsulatability in tools	✓	✓	✓	✓

Table 3-7: Exemplar Researchers' Reasons for Selecting an Ontology as Their Designed Artefact Contrasted to Identified Attributes of an Artefact with High Utility to the Organizational Sustainability Problem Domain

Exemplar Organizational Ontology's Key Theoretical Frames

Reviewing Osterwalder, Bullinger and Al-Debei's work and synthesizing enables a perspective on the shared context of these ontologies to be identified, i.e. a single description of the problem space in which all these ontologies were intended to have utility (Figure 3-9) [38]. Hence, this context also applies to the artefacts resulting from this research.

[38] For example, Osterwalder first identifies business modelling (i.e. creating a business models) as a design step between strategy and the design of the business processes executed by an operating firm in 2001/2002 (Osterwalder, 2001; Osterwalder, 2002b)

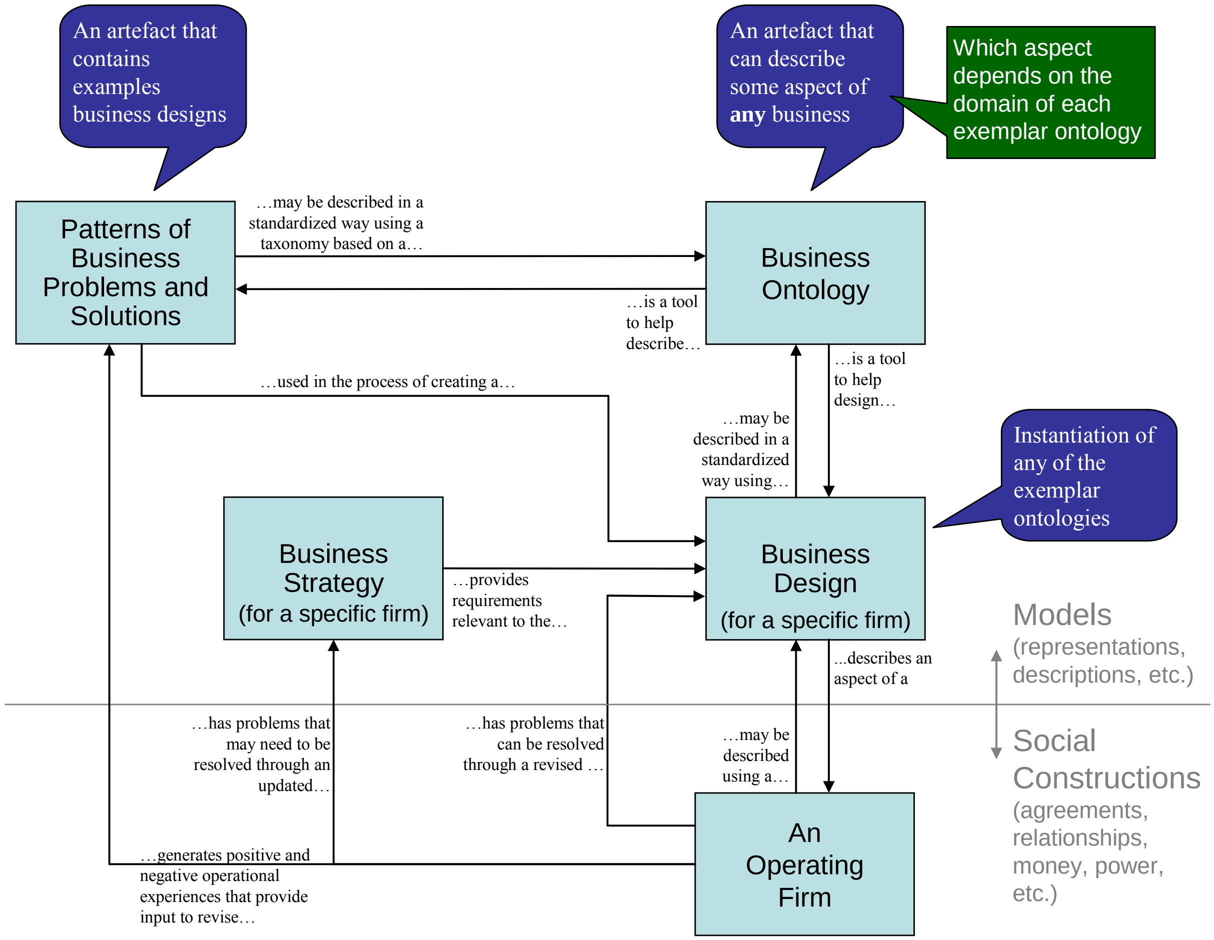

Figure 3-9: Problem Space of Exemplar Organizational Ontologies

Each of these researchers:

- Created a business related ontology related to a specific domain of business (Osterwalder: Business Models, Bullinger: Organization's Innovation Process, Al-Debei: Mobile Data Services) in a range of economic sectors (Osterwalder and Bullinger tended to imply or assert the greatest generality, and provided some evaluation activities to support this. By definition Al-Debei's ontology relates specifically to the mobile telecommunications sector).

- Indicated how their ontology could be instantiated to describe the ontology's domain in an existing firm (i.e. specific existing: business models, innovation processes and mobile data services respectively)

- Imply or assert that their ontology, with input from a firm's strategy, could be used in a design mode to more successfully create solutions within the ontology's domain (i.e. improved: business models, innovation processes and mobile data services respectively)

  This perspective is supported by

  – Magretta who states "a business model is not the same thing as a strategy, even though many people use the terms interchangeably. Business models describe, as a system, how the pieces of a business fit together. […] Strategy explains how you will do better than your rivals" which means being in some way different from them. This may mean executing a common business model differently, or defining a business model that is unique in some way (Magretta, 2002, pp.91-92).

  – Whitle and Myrick who state that "enterprise business architecture forges links between corporate strategy and tangible results" (Whittle & Myrick, 2005, p.182).

  – Mäkinen, and Seppänen who suggest that "business [design] could serve as an intermediate object of analysis between the resource configuration and strategy in venture creation. This provides the missing link between strategy and operations in exploiting entrepreneurial opportunities" (Mäkinen & Seppänen, 2007).

  – The Business Architects Association, who identify business architectures (i.e. business designs) as an artefact required in the process of translating strategy into an operating business (Bodine & Hilty, 2009, See also "Business Architecture" in the annotated glossary).

- Imply or assert that their ontology could be used as a taxonomy (aka a "pattern language" after Alexander, 1977) to describe genericised problems and solutions in their ontologies domain (i.e. classes of business models, innovation processes and mobile data services possibly applicable to many problem situations).

Summarizing: these three researchers all observed how ontologies can be used to express problems and solutions in the inter-related management fields of Innovation, Strategy, Operations Management and Management Information Systems (OM/IS) in a wide variety of economic sectors.

This also lends further support to the earlier identification in this research of these same fields as necessary key theoretical frames for creating ontologies related to organizational problems and solutions.

Exemplar Organizational Ontologies Use as Tools

Recalling Attribute 4 of artefacts which may indicate their utility to researchers and practitioners: their encapsulatability in tools to support efficient and effective scaling of the use of the artefact (3.5.1.1): Have these exemplar ontologies been used as tools, and if so at scale?

All three researchers instantiated their ontologies to describe sample problems / solutions at one or more firms (the scope of the description depending on the domain of each ontology). Instantiation of each ontology was done as part of the process of gathering comparator knowledge in the evaluation activity. The instantiations where created so that the process of instantiation and the instantiated ontology could be used to gather feedback on ontology utility.

In all cases this feedback was gathered from managers in the firms whose problems / solutions was described using the ontology or one or more tools conceptually 'powered by' the ontology, i.e. a visual or textual simplification or reconceptualization of the ontology that remained 'compatible' with it. This was done in order make each ontology more accessible to managers from whom feedback was being gathered. In turn this enabled the researchers to gain a better understanding of each ontologies utility in a practical context. In one case the visual tool powered by the ontology was subsequently labelled a "canvas".

In all cases managers in firms participated in the process of instantiation of each ontology and in other parts of the evaluation process, albeit to varying degrees.

In this way all three researchers gathered some feedback on their ontologies utility as a tool. As mentioned above, as a result all three, to varying degrees, claimed their ontology could be instantiated by managers in both a descriptive mode to better understand current realities (as demonstrated in their evaluation) and in a design mode (to create instantiations based not on current realities but desired ones).

However, to date only Osterwalder has achieved wide-spread practitioner use in both a descriptive and design mode[39] with

- A range of paper-based and computerized visual design tools derived directly from and "powered by" his ontology[40],
- An active on-line community[41],
- A blog[42], and
- A consulting and speaking business to advise managers on designing business models using the tool and patterns of profitable business model designs[43].

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[39] Osterwalder has stated via Twitter that his popular book (Osterwalder & Pigneur, 2009) has, as of July 2012, sold over 350,000 copies in 23 languages since launch in 2009. Further that the book has been in the top ten amazon.com business books for most of the time since publication by Wiley in 2010. In addition, to my personal knowledge: courses on strategy, innovation and entrepreneurship at number of schools of business and design are now using this book and the tool version of Osterwalder's ontology as a course text; a number of social, sustainability and profit-first entrepreneurs are also actively using these tools.

[40] Osterwalder derived his paper based Business Model Canvas (BMC) visual design tool directly from the Business Model Ontology (BMO) (Osterwalder, 2010, 2011) and subsequently increased the utility of the BMC through a range of computerized visual design tools (Osterwalder & Smith, 2012; A. Smith, Osterwalder, Business Model Foundry GmbH, & Hortis - Le Studio, 2011). He continues to elaborate the BMC, recently collaborating to create a Value Proposition Canvas visual design tool which complements aspects of the BMC.

[41] http://businessmodelhub.com/, 10,000 members as of October 21, 2012 (From Alexander Osterwalder via Twitter)

[42] http://www.businessmodelalchemist.com/

[43] http://alexosterwalder.com/

This success lends tremendous face value to Osterwalder's Business Model Ontology (BMO) and the Business Model Canvas (BMC) visual design tools it powers. However, it should be noted that academic interest in understanding Osterwalder's ontology, canvas and their success has been very mixed; this has greatly annoying some practitioners (Stähler, 2010).

Exemplar Organizational Ontologies Visual Design

A Picture is Worth a Thousand Words

Humanity has a rich tradition of creating depictions of artefacts observable to the eye and finding these useful in building understanding and in inter-personal communication.

Examples of visual representations of artefacts (labelled here as Type A[artefact]) include:

- Blue prints of to be physically instantiated buildings
- Computer user interface designs to be virtually instated in software to create virtual on-screen elements

There is also a rich tradition, particularly in management consulting, that builds on Type A visualization. This tradition uses consistent visualization templates (or tools) to help describe problem / solution situations that occur frequently (labelled here as a Type T[ool]). Using such tool visualizations is believed to improve the efficiency of gaining or communicating knowledge of the problem / solution for each situation and across situations. This is supported by the author's personal practical experience. The (infamous) two by two matrix is one such visualization tool.

All three of the exemplar organizational ontology's were expressed visually (usually with accompanying textual description) (Type A), although each used differing degrees of visual formalisms (perhaps reflecting Bullinger's advice on ontology type above).

All also used this same visualization as a template for instantiations of their ontologies, i.e. a description, for a specific firm, of their ontologies problem / solution domain (Type T).

These instantiated visualizations varied, sometimes being:

- Identical to the whole or a part of the visualization of the ontology
- A complete or partial elaboration of the visualization of the ontology
- A simplification of the visualization of the ontology.

To varying degrees these researchers implied, asserted and formally justified (via comparator knowledge gathered during evaluation) that their choices of visualization in one or both visualization usage types added to the utility of their ontology in its problem / solution domain.

As mentioned above, subsequently Osterwalder has derived practitioner visual design tools 'powered by' his BMO[44]. In doing so he choose to invest heavily in the visualization of this tool, based on the on-going feedback from managers, entrepreneurs and teachers (his tool's primary user groups) of the benefits of visualization and visual design techniques. Osterwalder has described in some detail his experience of this aspect of his work[45].

A recent academic review of Osterwalder's popular work specifically mentions the value of the visualization technique (as well as other aspects of the popular tool):

This practical book is the result of rigorous research undertaken over the last decade and can be used as a handbook to improve business models. A major advantage of the book is its graphics, which communicate its message clearly, hand-in-hand with its straightforward narrative. (Oliveira & Ferreira, 2011, p.4)

[44] It is clear from available documentation, visual similarity and use, that the BMO conceptually 'powers' the BMC visual design tool – i.e. while different the BMC remains compatible and conceptually aligned with and dependent on the BMO.
[45] See multiple blog posts since 2007 on visualization at http://www.businessmodelalchemist.com/ as well as presentations (Osterwalder, 2010).

Exemplar Ontologies and Organizational Sustainability

Although these works were not explicitly focused on the integrated challenges of environmental, social and economic organizational sustainability, each of these researchers can be considered as tackling a sub-set of this problem (primarily in the economic domain with some aspects from the social). As a result it is unsurprising that these researchers did not consider Attribute 1 of artefacts which may indicate high utility to organizational sustainability research: the encapsulation of facts and values, as of importance to their research (3.5.1.1).

However other researchers, including those outside the field of management, are making use of ontologies as useful designed artefacts in the sustainability problem domain. Hence, these researchers are explicitly using ontology's generic ability to represent both facts and values (As two examples see Edum-Fotwe & Price, 2009; Netherwood, Buchanan, Stocker, & Palmer, 2006)[46].

3.5.1.4 Business Models

Up to this point the term "model of business design" has been used to describe the output of this research. Searching the literature uncovered a more specific term and a considerable body of literature focused on it: business models, hence its use in the title of this research.

A recent review of the literature on business models identified its first use in 1957 (Bellman, Clark, Malcolm, Craft, & Ricciardi, 1957) with little use until the internet entered the consciousness of business leaders as a disruptive force to established business models in the mid-1990s. By 2000 the practitioner business press were publishing approximately 400 articles and the academic press about 75 articles per year on the topic. By 2011 these numbers had reached just over 1000 and 200 respectively per year (Osterwalder & Pigneur, 2005, p.4; Stähler, 2002a, p.4; Zott, Amit, & Massa, 2011a, Fig.1 p.5).

[46] The "relational ontology" presented by Neatherwood et. al., based on the work of Silfe (2004) is an example in another field (education) of the journey from ontology to recognizing that multiple ontologies may exist and that each may have practical value. For addition details of the use of ontologies to represent values see this presentation by Stocker one of Neatherwood's co-authors (Stocker, 2006). In these works while a visualization of an ontology is not presented it is clear that these authors consider there to be more than one valid approach to ontological thought – in this case mediated by the needs to consider facts and values related to education.

The detailed search of and reflection on this literature is a focus of the preparation activity stream (Chapter 4). This same search of the literature is then used to inform the creation of the detailed research design for the build activity stream (Chapter 5) and the sustainable business model ontology itself (Chapter 7).

However, at this point in the creation of the overall research design it is worth noting that all the business model literature searched strongly intersects with the key theoretical frames identified above. Further, for the purposes of the overall research design, three key points from the literature are relevant: a working definition of business models, a review of business models as research units of analysis, and the connection between business model and ontological design science research.

Definition of Business Models

The literature notes the term business model is very widely used in both academic and popular articles without definition (Stähler, 2002a, p.4-5). However, the three exemplar business ontology works introduced above all rely on the definition provided in the earliest of them:

"A Business model is an abstract conceptual model that represents the business and money earning logic of a company" (Osterwalder, 2004a, p.15)[47].

Summarizing the purpose of a business model, and aligned with Osterwalder's perspective, Gilssman and Sanz state that a:

"Business model is a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money" (Glissmann & Sanz, 2009, p.4).

Fully justified in Chapter 4, based on the review of the literature, in this research the working definition of a business model is:

[47] 296 citations as of May 2011, grown to 574 by Oct 2012 (as per Google Scholar)

A description of the rationale of an organization's existence: who it does it for, to and with, what it does now and in the future, how, where and with what does it do it, and how it determines and measures its success.

or

A description of how an organization can succeed over time.

Business Model as the Research Unit of Analysis

Historically the unit of analysis in much business research has been the business unit, the economic sector and the firm, usually aligned with the legal definition.

However business models, particularly given the importance to achieving value, capture of interactions amongst multiple persons and organizations, usually involving multiple legal entities.

This was first acted upon in his 2002 PhD by Stähler (Stähler, 2002a; Stähler, 2002b) with his choice of business model as his unit of analysis. Stähler argued that the business model was now the "locus of innovation" (Stähler, 2002a, p.3; Stähler, 2002b) and hence was the necessary focus of his research on the impact of the internet on business designs.

Both Osterwalder and Al-Debei followed suit with the choice of business model as their unit of analysis, with Osterwalder focusing on firms' business models and Al-Debei focusing on mobile telecommunications data service' business models (Al-debei, 2010; Osterwalder, 2004a).

Subsequently in a recent review of business model literature Zott et. al. justified the "wide spread acknowledgement […] that the business model is a new unit of analysis distinct from the product, firm, industry" (Zott, Amit, & Massa, 2011a, p.2) by stating "the locus of value creation, and thus the appropriate unit of analysis, spans firm's and industries' boundaries. […] Prior frameworks [to business models] used in isolation cannot sufficiently address questions about total value creation" (p.11).

Business Models in Ontological Design Science Research

Now the concept of the business model has been defined, revisiting the exemplar business ontologies produced using a design science epistemology, the domain of all three of these ontologies can be seen to relate to the business model concept:

- Osterwalder's ontology domain ***is*** the business model.
- Bullinger's ontology domain is the subset of a business model related to the innovation process (she explicitly derives her ontology from the business model literature, including Osterwalder's work).
- Al-Debei's ontology domain is a sector specific business model related to mobile telecommunications data services (he too explicitly derives his ontology from the business model literature, including Osterwalder's work).

The earlier analysis showing how these scholars selected ontologies because of their high utility to managers (Table 3-6 and Table 3-7), coupled with the recognition that these works are focused on business models, further indicates that, in general, business model ontologies have high utility to managers.

3.5.1.5 Applying Research on Artefact Utility to Creation of a Model of Sustainable Business

The above completes the search of the literature related to finding artefacts of high utility in organizational sustainability research (Challenge One, introduced in 3.5.1). Reflecting overall, given the objective of this research, business model ontologies is the best type of artefact.

To guide a more detailed reflection on this literature and to apply the results to this research design a new question is:

> How to best apply (operationalize) the knowledge of business model ontology artefacts given the research objective?

Based on the literature presented above this question is answered under this heading resulting in the second pass of the overall research design (summarized in Figure 3-12 below), building on the first pass (3.4.9).

Chosen Artefact and Unit of Analysis: A Sustainable Business Model Ontology

Although there are no doubt other artefacts which may have high utility to managers focusing on their organization's sustainability, the literature related to ontologies and business models appears highly sympathetic to the objective this research.

> In this research the artefact to be built and evaluated is an ontology; an explicit partial account of a shared conceptualization of any possible sustainable business model.

Reflecting critically, this finding of sympathy may be due to researcher bias. As noted in 1.1, this researcher's information systems disciplinary background provides a familiarity with the concept, tools and techniques for the construction and application of abstract conceptualizations. Business models and ontologies in general are the output of such abstraction. Hence it is possible the researcher's background may have reduced the ability for the researcher to find sympathy for other artefacts of high utility to the research objective.

In spite of this possibility, recalling that the literature on business models will be reviewed in detail in Chapter 4, based on the research objective

> In this research the unit of analysis is the business model[48] of an organization.

Further, in this thesis a sustainable business model is:

[48] Anticipating Chapter 4, this choice of unit of analysis is aligned with Osterwalder's which makes it possible for this research to use his business model ontology as a starting point for critique and elaboration given the different objective of this research.

A description of the logic of an organization's existence: who it does it, for, to and with; what it does now and in the future; how, where and with what does it do it; and how it defines and measures its success.

Or simplifying further a business model is:

A description of how an organization defines and achieves success over time

Chosen Ontology Type

The sustainable business model ontology, following Osterwalder, is

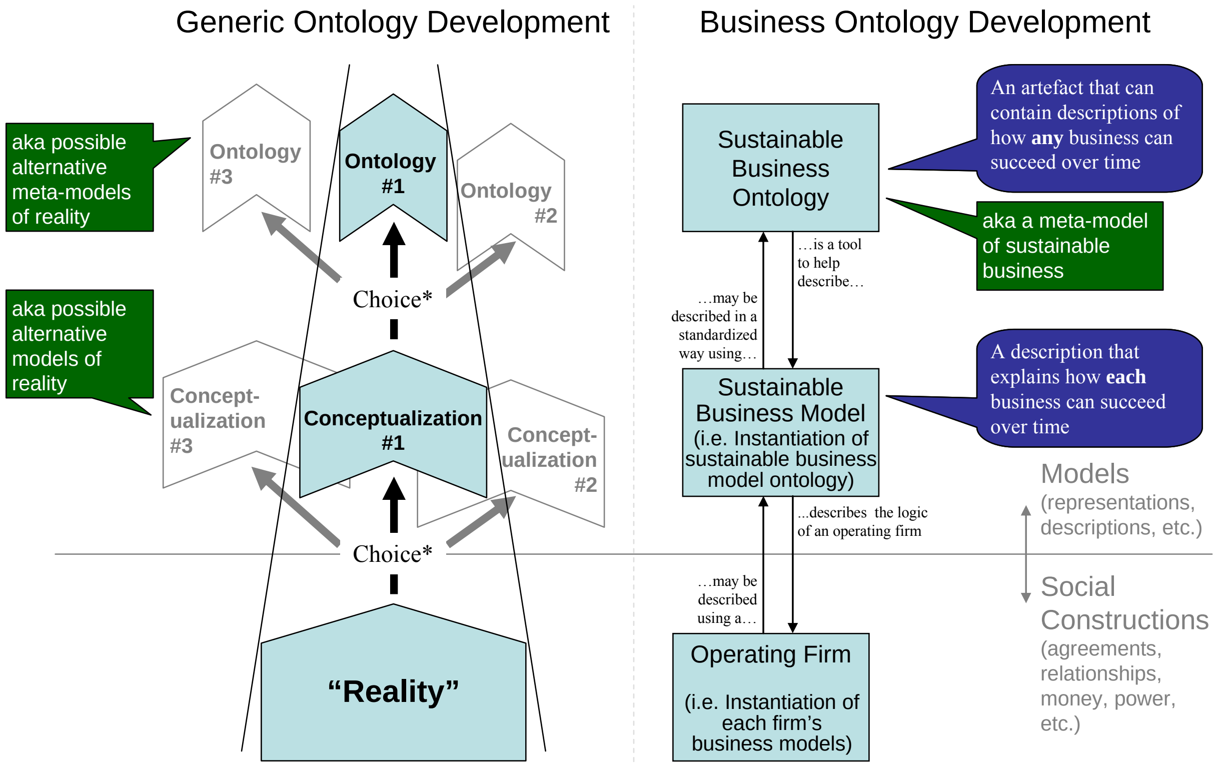
A "domain ontology" (a reference model) expressed in a "semi-formal" language.

From a disciplinary perspective, following the exemplar business ontologies, the sustainable business model ontology is an Information Systems artefact.

Relationship of Ontology Design, Business Model Design and Business Model Design Enabled by a Business Model Ontology

Following the shared understanding of the problem space developed from the review of exemplar organizational ontologies (Figure 3-9) an understanding of the problem space for this research was developed (Figure 3-10).

Although not shown in this figure the larger problem space for this research has the same relationship to patterns (of sustainable business models) and (sustainable) business strategy shown in Figure 3-9. They are omitted from Figure 3-10 as these elements of the larger problems space are, by choice, not in the scope of this research for pragmatic reasons of time and effort (2.6).



* Choice = decision based on human purpose (hence human value judgement), i.e. design is inherently normative; choices of relevant values and knowledge need to be made as explicitly as possible to maximize rigour in design science and ontology engineering research.

Figure 3-10: Abstraction in Generic Ontology and Business Ontology Development
(Inspired by Bullinger, 2008, Fig.45 p.142; and Inspired by Osterwalder & Pigneur, 2005, Fig.2 p.5)

The left side of Figure 3-10 is the generic process of ontology development, showing the necessary two levels of abstraction from 'reality' – the first labelled conceptualization and the second ontology. In this research the ontology artefact is a meta-model (a model of all possible business models). Also shown, once again following the advice on rigor and legitimacy is the role of choice in this process of abstraction.

The right side of Figure 3-10, is inspired by the generic process on the left and by the overall understanding of the problem space from the exemplar business ontologies (Figure 3-9). The right side of Figure 3-10 shows the abstract process of development for the sustainable business model ontology. It is abstract in the sense that the creation of sustainable business model ontology is not accomplished through the abstraction of actual business models[49].

Instead, in this research, the practical process to build the ontology involves using the output from the literature review undertaking in preparation activity stream to build the ontology, i.e. the review of the key theoretical frames relevant to the research objective[50].

Reflecting critically on this choice: It has the benefits of:

- Making the research process more controllable (less interaction required with managers) (a significant pragmatic concern),
- Potentially increasing the genericism of the ontology (it is based on the credentialed knowledge from the key theoretical frames) not on the mostly uncredentialed knowledge from a (relatively) few managers.

However, it has the potential drawback of reducing the completeness, quality, beauty[51] and hence utility of the ontology because a bias of the single researcher may cause a key theoretical frame required to maximize artefact utility to be 'missed'.

Achieving the Generic Benefits of Ontologies with the Sustainable Business Model Ontology

The two generic benefits of organizational ontologies identified by the literature are that they may enable enhanced communication and co-ordination between stakeholders (3.5.1.3). These benefits are enabled by the embedding in the ontology of knowledge from the key theoretical frames relevant to the ontologies domain. This

[49] Inspired by grounded theory such a process might be referred to as "grounded ontology development" and was the approach taken by Bullinger for the development of her ontology – in which she interviewed multiple managers about their specific organizations and then abstracted her ontology from these firm specific models.
[50] This practical approach was employed by Osterwalder and Al-Debei. In this research, however, the process is formalized (a possible methodological contribution), by capturing the aspects of the literature salient to the ontology in ontology Detailed Design Principles (DDP). This approach is fully described in Chapter 4.
[51] These three "aspects of utility" are derived from the literature on evaluation (3.5.1.2). Their use in this research is justified in the detailed design of the evaluation activity stream (Chapter 6).

allows sharing of this embedded knowledge with the ontology's users and hence the benefits to be realized.

To enable these benefits, and hence be useful, the sustainable business model ontology needs to prompt managers with ideas that could lead to their business model designs being more environmentally, socially and monetarily sustainable than would have otherwise been the case if the ontology was not used. This 'prompting' occurs through the designers own learning processes which occur in the use of and engagement with the ontology to describe or design a business model.

A popular pedagogical belief is that humans' predominant mode of consciousness leads to negative emotions when confronted with information that contradicts currently held beliefs (and the knowledge that is believed to be legitimate based on those beliefs / world-view / value-system) (Haidt, 2006; Haidt, 2012; Macy & Johnstone, 2012; Scharmer, 2007; Senge, Scharmer, Jaworksi, & Flowers, 2005). Hence for learning to be successful, learners are required to (re)consider currently held beliefs in light of knowledge novel to the learner. Learning can only occur if the learner is the 'right frame of mind' and has a willingness to engage with and possibly re-consider their (deepest held) beliefs and values in light of knowledge novel to them. This latter mode of consciousness is not one that most people, including managers of firms, are in most of the time[52].

The knowledge, and the world-views / value-systems underpinning that knowledge, of how managers might avoid adding to and better contribute to the resolution of the Global Problématique are not well understood and / or accepted by the majority. This is demonstrated by the identified gap in the literature: the lack of a common

[52] While out of the scope of this research (Limitation L6, 2.6), it is noted that this understanding of a barrier to human learning creates a very significant design challenge for any method that has a goal of maximizing the effective use of the artefact created by this research in a design mode (i.e. enabling managers to create high quality sustainable business models).

definition of organizational sustainability and examples of organizations believed to be sustainable[53].

Hence, given the objective of this research, achieving the generic benefits of ontologies is a considerable challenge, due to the:

- Predominant (albeit understandable) lack of understanding / acceptance of the necessary knowledge and underlying world-views related to organizational sustainability.
- Implication of the predominant mode of consciousness which sets up considerable barriers for the learning that might lead to the adoption of the world-views necessary to act.

In practice these challenges make it hard for managers to design, adopt and operationalize more sustainable business models and for researchers to design tools to help them accomplish this goal. This is a very significant reason why a solution that meets the research objective is not obvious or certain, but would be highly useful[54].

In summary: being prescriptive is known to be not a good way to communicate, help people learn and increase the likelihood of action aligned with novel knowledge. Conditions need to be created to maximize the likelihood for learning, and the design of tools impacts the creation of these conditions.

Having completed a search of the literature on ontologies and concluded that business model ontologies are the best artefact for this research, the critical reflection above on this choice, in light of the research objective, identified several challenges for the

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[53] The body of knowledge referred to was introduced above (3.4.6.1). For the formal identification of the key theoretical frames that include this knowledge see 3.5.3 below; this knowledge is explored in detail in Chapter 4 including the measures which lead to this assertion.

[54] The exemplar business ontology works described earlier largely did not face this challenge as the neo-classical economic / capitalist world view was (correctly) assumed to be predominant in the users of those ontologies.

Hence while these ontologies clearly contained novel knowledge for most managers this knowledge tended not to conflict with those managers deepest held world-views and value systems. This assertion is partially supported by the lack of feedback on this topic gathered during the evaluation of these ontologies (although this may also be because these researchers did not ask specific questions to surface this challenge).

research design. This leads to a clarifying question related to the application of all this knowledge in this research:

How to best achieve the generic benefits of ontologies given the research objective?

The chosen response is two fold.

First: Leverage the generic conceptual capability of ontologies identified in the literature to encompass knowledge based on multiple world views. This means the key conceptual frames required to build the ontology should include two some-what contradictory prescriptive perspectives:

1. The predominantly accepted model of business underpinning the key theoretical frames identified above (under 3.5.1.3), as encompassed in the exemplar business ontologies reviewed (The relevant components of the key theoretical frames are labelled "K0-PF" for "Profit First").

2. A sustainable model of business suggested by synthesis of the literature introduced above (The relevant components of the key theoretical frames are labelled "K0-SS" for "Strongly Sustainable"[55]).

The knowledge which is aligned with these world-views was introduced in 2.1, and is explored in this chapter (3.4.6.1 above and 3.5.3.1 below) and elaborated in increasing detail in Chapters 4 and 7.

Again based on the generic conceptual capabilities of ontologies, this approach should enable instantiations of the ontology to describe business models with a range of outcomes (from monetary only to integrated environmental, social and monetary sustainability).

As a result, when in use by managers describing their existing business model or attempting to designing future more sustainable business models, a spectrum of

[55] Term "strongly sustainable" will be defined in 3.5.3.1

possibilities then arise in those managers' interaction with the ontology. The extreme ends of this spectrum are:

- Rejection of any knowledge in the ontology which is novel to them: no change in their world-view / value-system.
- Acceptance of all knowledge in the ontology which is novel to them: a (possibly significant) change in their world-view / value-system.

In other words, a design principle for the sustainable business model ontology is to take an empathetic approach to its users existing world-views and the knowledge they believe to be true. This is overall ontology design principle two:

ODP2: The sustainable business model ontology takes an empathetic stance towards its users, their knowledge and beliefs: it does not prescribe; it does not require the user to change.

This ontology design principle acknowledges that the ontology's users' world-view takes precedence when they interact with the ontology; further only the user can choose a mode of consciousness that may result in their world view aligning more closely with the world views of the ontology's key theoretical frames.

By stating this goal explicitly the intent is to design the artefact in such a way to achieve the generic benefits of ontologies despite the identified challenges, in order to maximize the achievement of the research objectives.

If users choose not to learn from the knowledge embedded in the ontology this limits the achievement of the research objective. However, it is generally recognized that few people fail to learn anything from an interaction with novelty (i.e. the modes of consciousness and their implications for learning are not absolute at any point in time nor over time). Hence, in most cases it is expected that users will learn something of what is required for more environmentally, socially and economically sustainable business models to be described or designed. It is asserted, in more cases than not, materially more sustainable business models will be designed using the ontology than without it[56].

Put another way: for the sustainable business model ontology to be 'easy to use', while at the same time solving the business problem at the heart of this research, requires that it allow the user to:

1. Represent a business model irrespective of the user's world-view on the continuum of profit-first to sustainable (single loop learning)
2. Be challenged by the constructs and relationships in the ontology that represent the key theoretical frames containing both world-views (double loop learning) (M. K. Smith, 2001).

This sets up a potential for a reflexive learning process for the ontology's user. The user, if they are open to such a learning process, can understand and subsequently explicitly choose their business model design with a more complete picture of its implications. Further, by avoiding being prescriptive about sustainability, it is hoped that the ontology is easier to engage with if the user has the predominant profit-first world view.

Two examples:

- A user who has little knowledge of or interest in sustainability will still be able to use the ontology to design a profit first business model. But as they do so, the existence of constructs and relationships in the ontology that allow a sustainable business model to be described will be evident. This, if the user is willing, will present opportunities for learning about possibilities for sustainable business model designs that the exemplar business ontologies do not allow.
- A user has a lot of knowledge of sustainability will be able use the ontology to design a strongly sustainable business model. But as they do so, the existence of

[56] As noted in the designed limitations (L6, 2.6) the evaluation activities required to gather evidence to support this assertion are out of scope. The basis for the assertion is based on the evidence and argument presented here.

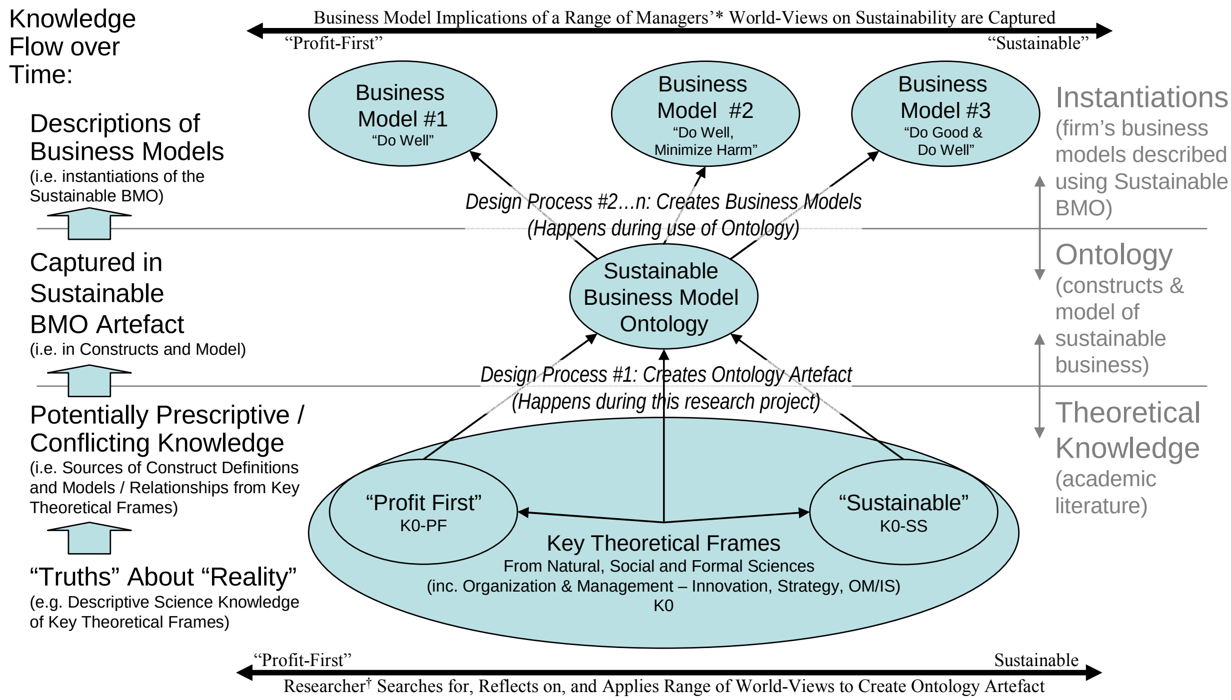
the constructs and relationships in the ontology which allow a profit first business model to be described will be evident. This, if the user is willing, will present opportunities for learning about business model designs which can enhance monetary profit-making – a key element of a sustainable business model, according to the key theoretical frames[57].

Figure 3-11 summarizes the approach taken to adhering to ontology design principle #2 and hence to maximize the likelihood of meeting the research objectives.

Figure 3-11 shows details of the flow of knowledge over time during the creation and use of the sustainable business model ontology. Starting from the bottom of the figure, theoretical "truths" about "reality" are shown as originating in the relevant key theoretical frames (K0) created by descriptive science. This sometimes results in conflicting prescriptive knowledge (labelled K0-PF and K0-SS) about sustainability, business and business models because of the differing world-views used to theorize. All the relevant knowledge from key theoretical frames is captured in the sustainable business model ontology through the process of design undertaken in this project (Design Process #1). Finally, managers use the ontology to capture or create and then describe knowledge about their current and / or future business models.

The right of the figure and the horizontal lines categorize the steps of the flow based on the "container" or "medium" for the selected knowledge. Starting from the bottom right of Figure 3-11: academic literature captures theoretic knowledge (the key theoretical frames); The ontology captures knowledge in its constructs and model; Instantiations of the ontology captures knowledge about a firm's current or future business model.

[57] Based on personal experience with several consulting clients and prospects, understand the design of financially viable business models, is key challenge for 'social business' at present.



* i.e. the ontology's users: business model designers,

† i.e. the ontology's designer entrepreneurs, business architects, management consultants etc.

Figure 3-11: Designed Knowledge Flow Over-Time
(Enabling Generic Ontology Benefits by Incorporating Multiple Key Theoretical Frames Based on Prescriptive and Conflicting World-Views)

Because of the inclusion of potentially prescriptive knowledge based on multiple world views (K0, K0-PF, K0-SS) the sustainable business model ontology can describe business models based on a range of manager's world-views[58, 59]. The actual or desired business models of firms, described by managers of those firms using the sustainable business model ontology are shown towards the top of Figure 3-11. The labelling of these business models illustrate the ability to describe firms with a range of manager's world-view: variants of the oft-used description of a

[58] Confirming this aspect of the sustainable business model ontologies utility is key to meeting the research objectives.
[59] See the evaluation activity stream detailed design (Chapter 6) and the evaluation results (Chapter 8 & 9) for the justification for this assertion.

sustainable business[60]. A sustainable business is one that "does well" (i.e. is monetarily sufficiently profitable) and "does good" (i.e. generates a monetary surplus while enhancing society and the biosphere).

Design Process #2 occurs during this research when instantiations of the ontology (descriptions of actual operating firm's current business models) are created as a part of the evaluation of artefact utility. Use of the ontology in the design mode (descriptions of desired business models) is not in the scope of this research, [61].

Second: Given ontology design principle #2, and reflecting on the exemplar ontologies use of visualization, suggests a second approach to best achieving the generic benefits of ontologies given the research objective.

In order to maximize the possibility for managers to be able to gain the prospective benefits of the ontology and hence give the most feedback on its utility, a conceptually compatible albeit simplified visualization of the ontology must also be prepared during the design activity stream: The sustainable business model canvas[62].

The sustainable business model canvas is a simplified visually attractive tool powered by and hence conceptually compatible with the sustainable business model ontology.

The sustainable business model canvas is used during the evaluation activity stream to help gather the comparator data required to evaluate the utility of the sustainable business model ontology.

---

[60] Author has been in multiple academic lectures and practitioner events and meetings when this description was used or alluded to.
[61] However, the use of the sustainable business model ontology in the design mode is expected and desired to fully realize the utility of the ontology in practice (and hence achieving the researcher's wider objective of a desirable change in the world: increasing numbers of sustainable firms). Osterwalder has demonstrated since completing his PhD, using the BMC, that such an expectation and desire is realizable.
[62] In the design mode this would be called a visual design tool, recalling Osterwalder's visual design tool, the BMC.

Concluding on the question introduced under this heading (3.5.1.5): "how to best apply (operationalize) the knowledge on ontology artefacts?" and the clarifying question: "how best to achieve the generic benefits of ontologies" in this research design.

Based on the reflection presented above these questions were answered under this heading. This results in the second pass of the overall research design (summarized in Figure 3-12 below), built on the first pass introduced earlier (Figure 3-8).

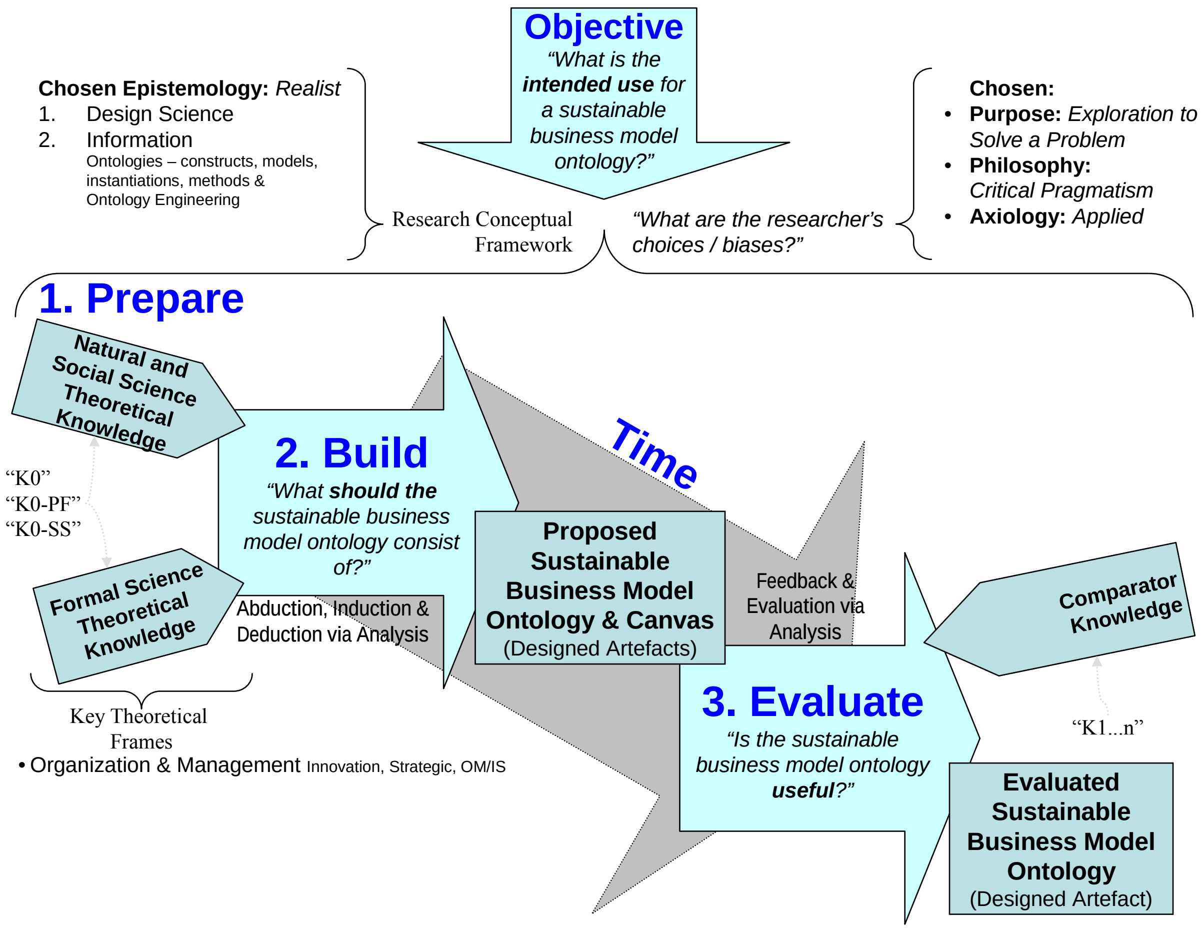


Figure 3-12: Overall Research Design – Second Pass

Compared to the first pass (Figure 3-8), this summary reflects the choices that add and / or refine the following aspects of the overall research design:

- Updating the questions related to the definition of:
  - Research objective
  - The activity streams build and evaluate.
- Adding the epistemology of the formal science of information (computation), specifically ontologies as a type of artefact (consisting of constructs, models, instantiations and methods) and the associated methodologies / techniques (Ontology Engineering).
  - Relabeling of the artefact to be built and evaluated to reflect its content – the sustainable business model ontology.
- Adding the sustainable business model canvas to the artefacts created by the build activity stream. The canvas is conceptually 'powered by' the ontology and is used during the evaluation activity stream to make it easier for managers to provide feedback on the utility of the ontology.
- Adding the necessary key theoretical frames, based on the business model as the unit of analysis: the fields of Organization and Management – specifically
  - Innovation
  - Strategy
  - Operations Management (OM)
  - Management Information Systems (MIS)
- Adding the identification of different world-views leading to distinct bodies of knowledge within the overall key theoretical frames (K0):
  - Profit-First (labelled K0-PF)
  - Strong Sustainability (labelled K0-SS)

3.5.1.6 Meeting the Research Objective and Testing the Working Hypotheses

Recalling the overall objective for this research (2.2) and the working hypotheses (2.4): The rationale for choosing, and the choice of a business model ontology as the artefact to be built and evaluated in this research, adds to the evidence already presented suggesting that the research question can be answered in the affirmative and that working hypotheses are confirmed.

3.5.2 Challenge Two: Rigor in Design Science Organizational Sustainability Research?

Now turning to Challenge two (introduced in 3.5) "How to ensure rigour in this organizational sustainability design science research?" Once again following the three steps introduced at the start of this part. A search of the literature for advice on how best to respond is presented below. A reflection on this advice and its application to this research design follows.

This second challenge to the use of design science for organizational sustainability research recalls the literature's advice on legitimacy. This challenge centres on how to ensure sufficient rigor in the process of undertaking organizational sustainability research using design science to ensure the highest degree of legitimacy for the knowledge produced.

Earlier, as the design science epistemological approach was reviewed, the literature's advice on achieving rigor when applying this approach to organizational research was identified (3.4.7). This sub-section now searches the literature to seek answers to a more specific question:

> Is the design science literature's advice on rigour in organizational research necessary **and** sufficient for organizational ***sustainability*** research?

3.5.2.1 Support of Overall Best Practice for Achieving Rigor

As noted in the introduction to this part: presenting the following body of methodological advice adds to that presented earlier supporting the recommendation that rigor is best achieved through **explicit** presentation of the researcher's choices, judgments (the world-view / value systems which drive those choices) and justifications.

3.5.2.2 Rigor in Organizational Research

The short answer to the question of whether the design science literature's advice on rigour is both necessary and sufficient for organizational sustainability research is no.

This conclusion was reached because:

- Design science literature was found not to contain advice on how best to understand the problem and solution domains of this research: organizations and sustainability.
- Literature from outside the design science suggests that both organizations and sustainability may be best understood when conceptualized in terms of systems.

Hence in order to understand and then answer Challenge Two, how to best ensure rigour in design science organizational sustainability research, a brief introduction to the organizational systems literature and its relationship to design is required. This is undertaken is this sub-section.

> *A Brief Introduction to Systems Thinking in Organizational Research*
>
> Beginning in the 1940's scholars have made an increasingly compelling case that understanding, rigor and hence legitimacy of results can be best achieved in organizational research through systemic concepts and processes. Jackson summarizes dozens of authors who take this perspective: an effective approach to the analysis of organizations requires a systems oriented perspective (M. C. Jackson, 2000). Others have also provided comprehensive (Horn, 2007; Midgley, 2000) and selective reviews (Ramage, 2009; Trist, 1992).
>
> Saraswat recognized the shift from the "machine age" to the "systems age" introduced in 1.2.2 and saw benefits of the systems perspective in information

systems organizational research (Saraswat, 1998). Saraswat provides a summary of the impact of this shift on organizational research conceptual frameworks and then uses these insights to identify a number of recommendations for information systems researchers in order for them to maximize research rigor.

Dimension of Comparison	Machine Age World-View	Systems Age World-View
Focus	Elemental	Holistic
Purpose[63]	Functional	Teleological
Relationships	Linear	Multi-Way
Interactions	Causal	Synergistic
Organization	Static	Dynamic
Environment	Closed	Open
Solutions	Analytical	Synthetic
Response	Reactive	Proactive
Motivation	External	Internal
Consequences	Deterministic	Stochastic

Table 3-8: Comparison of Aspects that Differ Between Systems and Machine Age Conceptual Frameworks
(from the Perspective of the Information Systems Field)
(Saraswat, 1998, Table 1 p.3)

This summary is highly sympathetic to an earlier work by Ackoff "Towards a System Of Systems Concepts" (Ackoff, 1971) (uncited by Saraswat). In this work Ackoff claims to set out for the first time a system of systems concepts "given […] that the type of system of most interest to management scientists [are] organizations" and directs it towards his students: to provide a "framework that will assist them in absorbing and synthesizing [the] large accumulation of insights" related to the systems view of organizations.

[63] Some authors would state the purpose of systems is to provide a function (i.e. it exists for the sake of an end – i.e. a systems age synthetic or contextual function). In common with the typical use in the study of digital systems, Saraswat uses the term functional to indicate that a purpose may be decomposed through the machine-age process of analysis into many parts. In the digital systems realm these parts are typically known as functions or functionalities. This is not to be confused with the teleological function of a system.

In this work Ackoff defines a system as:

"A set of interrelated elements. Thus a system is an entity which is composed of at least two elements and the relation that holds between each of its elements and at least one other element in the set. Each of the system's elements is connected to every other element, directly or indirectly. Furthermore, no subset of elements is unrelated to any other subset" (Ackoff, 1971, p.666!)

In the organizational context, Ackoff highlights that systems are abstract, highlighting the challenges of separating system elements from their representations (i.e. semiotic related challenges).

Ackoff then states that all systems have a state at any point in time and defines this as "a set of relevant properties". Further all systems have a containing environment or context and this too has a state at any point in time. Thus he defines a system's context as "a set of elements and their relevant properties […] not part of the system but a change in any one of which can produce a change in the state of the system" (p.663). He notes elements outside the defined boundary of the system that cannot change the system under inquiry are considered outside that system's context.

This latter definition highlights one of the critical differences between systems and machine age conceptions of reality. In systems thinking the (purposeful) human is considered as defining the boundary (of the system) of inquiry. In turn this defines the system: the parts it contains and it's containing whole (its context). Then, reflexively, as the defined system is inquired into the resultant learning may cause the human to redefine the system boundary. This (iterative) process may continue for as long as the human believes their purposes are being met. This strongly recalls Heidegger's hermeneutic circle introduced earlier in the context of the philosophical bias for this research (3.2.3.2) in order to better understanding the nature of design[64]

[64] Another name for Heidegger's hermeneutic circle is autopoieses: defined as a process of self-creation or self-becoming conceptualized in biology by Manturana and Varela, and introduced to the social sciences by Niklas Luhmann (Scharmer, 2007, p.463). Hence both Heidegger and Ackoff are suggesting that reflexively understanding this universal context, i.e. process of autopoieses, is critical to both the undertaking of an inquiry

Ackoff continues with a set of definitions related to: systems being open (it has context) or closed (it has no context)[65], and their change and behaviour over time.

In this last set of definitions Ackoff introduces a concept he (and others) would spend a large portion of the remainder of their considerable careers developing[66]: the organization as a purposeful system, explicitly relating systems thinking to human behaviour (in the organizational context). In this earliest work on purposeful systems by Ackoff, with only a nod to the earlier works of Churchman and Emery, the following definition is given, noting that human beings (and hence human organizations) meet this definition:

A purposeful system is one which can produce the same outcome in different ways in the same (internal or external) state and can produce different outcomes in the same and different states. [i.e.] A purposeful system is one which can change its goals under constant conditions; it selects ends as well as means and thus displays ***will****.* (Emphasis in the original Ackoff, 1971, p.666!)

Ackoff goes on to define "ideal-seeking" systems as a sub-class of purposeful systems, and following concise definitions of a goal (the preferred outcome of a purposeful system), objective (a goal which can only be achieved over longer periods of time) and ideal (a goal which is believed unachievable in any time period), states:

An ideal-seeking system is a purposeful system which, on attainment of any of its goals […] then seeks another goal […] which [it is believed] more closely approximates its ideal.

---

and any understanding that results. In Ackoff's case he was thinking specifically about this in the organizational context.

[65] Many would argue that the only example of a closed system is the Universe (atheistic world-view) or God (theistic world-view).

[66] Ackoff published "On-Purposeful Systems" with Fred Emery in 1972 (Ackoff, 1972) a year after "Towards a System of Systems Concepts" was released and in support of his systems oriented "Interactive Planning" approach to organizational improvement. Other scholars working to elaborate and that complement and critique systems oriented organizational thinking include: Jay Forrester (Hard Systems Dynamics), Stafford Beer (Viable Systems Model), James Miller (Living Systems), Humberto Maturana and Francisco Varela (Autopoiesis), John Warfield (Interactive Management), Wes Churchman (Social Systems Design), Richard Mason and Ian Mitroff (Strategic Assumption Surfacing and Testing), Peter Checkland (Soft Systems

Ackoff believed this was a good definition for any human organization.

One other stream from this considerable body of literature is relevant: the work of Eric Trist and his long time colleague at the Tavistock Institute of Human Relations Fred Emery, both of whom collaborated with Ackoff between 1960 and their death's. These practitioner / action oriented academics developed the idea of understanding organizations through a reflexive sociological and technical systems lens. Emery and Trist initially focused on the newly nationalized British coal mines in the late 1940's and early 1950's. This was partly inspired by personal war-time experiences in the British Army of the break-down of machine age command and control management systems which were seen as leading to unnecessary' death and injury. Over the following decades these researchers pushed forward our understanding of organizations as multiple related systems (Emery, 1997, first published 1967; Emery, 1997; Trist, 1981a; Trist, 1981b).

A Brief Introduction to Systems Thinking and Design

Having introduced the basic ideas of organizational systems thinking from the literature another question suggests itself before proceeding to develop a comprehensive response to Challenge Two. What is the relationship between systems thinking and the selected design science epistemology for this research:

> What, if any, relationship exists between the systems and design science organizational research epistemologies and related key theoretical frames?

The response from the literature is that there are significant relationships. In fact so intertwined is the relationship that a number of the organizational design science and system authors have concluded that there is a **necessary** reflexive reliance on the process of design in the methods for applying systems thinking to organizations (Ackoff, 1981a). The creation (design) of models of the system under exploration is a

---

Methodology), Peter Senge (Soft Systems Dynamics / Learning Organizations), Emery, Trist and others at the Tavistock Institute (Socio-Technical Systems) (M. C. Jackson, 2000) key part of gaining understanding of that system and hence of systems methodologies[67]

Gharajedaghi, writing of his first meeting with his then future PhD supervisor in 1974 recalled that Ackoff stated:

'Design is the future of systems methodology and is the vehicle through which choice is manifested' (Gharajedaghi, 2011, p.xi).

That design may be conceptualized as a generic ideal purposeful inquiring system brings this reflexive relationship of systems and design into sharp focus.

Writing 7 years before Ackoff spoke these words to Gharajedaghi, Emery one of the founders of socio-technical organizational thinking wrote:

In our view […] the […] problem [… is] soluble by a single strategy. The strategy is based on the notion that it is in the design of their social organization that men can make the biggest impact upon those environmental forces that mould their values (that make some ends more attractive, some assumptions about oneself and one's world more viable); further, it assumes that if these changes are made in the leading part, the socio-technical organizations, the effects will be more likely to spread more quickly than if made elsewhere. (Emery, 1997, first published 1967, pp.923-924)[68]

One culmination of the work of Emery and his collaborator Trist was the identification of "principles of work design", summarized by Trist towards the end of his career. Supported by more than 40 years of research, these principles of socio-technical systems design strongly suggest how organizational processes and the jobs that operate them can be created so that they are effective and efficient for both employer and employee – i.e. a high quality of working life results for the employee

[67]Noted in 2.5 Axiom #2.
[68] In this work Emery also spends considerable effort in dealing with the reality that Ackoff was to note: design is about choice – so how should those choices be best made? Again this informed the overall three step process used in the design of this research (See start of this part).

and their employer efficiently creates a high quality of output (Trist, 1981a, Table 2-1 pp.29-37; Trist, 1981b)[69, 70].

Summarizing the ideas of Emery, Trist, Ackoff: design and systems thinking are in fact necessarily reflexively related in the organizational context.

Work continues to elaborate and deepen these ideas developed in the 1960's and early 1970's. For example, the management and organization research community's understanding of and interest in this necessarily reflexive relationship between the social and the technological was one of the drivers of the 2006 launch of the International Conference on Design Science in Information Systems and Technology (DESRIST). Now in its 7th year, this conference regularly includes attendance and participation from members of the long standing International Society for the Systems Sciences (ISSS)[71].

Some of the relevant work presented at DESRIST has already been introduced. For completeness, the following works presented at DESRIST were found of relevance to this research:

- The Role of Theory and Theorising in Design Science Research (Venable, 2006)
- Design Research in Information Systems (Vaishnavi & Kuechler, 2009)
- Ontological Design (Ramaprasad & Papagari, 2009)
- Design Alternatives for the Evaluation of Design Science Research Artefacts (Cleven et al., 2009)

[69] These ideas relate to certain elements of social and monetary organizational sustainability and will be explored in Chapter 4.
[70] It is interesting to note that these ideas long preceded their recreation by Hammer and others in the Business Process Re-Engineering approach to organizational (re)design of the late 1980-early 2000's (Hammer & Mangurian, 1987; Hammer, 1993; Hammer, 1996). Further their recreation was without acknowledgement of the far more rigorous understanding of Emery, Trist and Ackoff..
[71] The International Society for the Systems Sciences was founded in 1954; founding President Kenneth Boulding. Subsequently, nearly all of the scholars mentioned by Jackson as well as many others have been president of the society. See Foot note 66.

- Soft (Systems) Design Science Methodology (Baskerville, Pries-Heje, & Venable, 2009)
- A Design Science Approach for Developing Information Systems Research Instruments (McLaren & Buijs, 2011)

There has also been some recognition in management school academics[72] of the need to ensure management and organizational research is 'compatible' with the latest knowledge from the natural sciences, knowledge that is increasingly based on the formal science of systems and complexity. For example:

- Checkland's exploration of the systemic design of information systems artefacts (Checkland, 1988; Checkland, 1998)(Checkland, 1988).
- Ormerod exploration of the use of Soft (systems) operation research methods in the design of an information systems strategy for a major UK supermarket (Ormerod, 1995).
- Broadbent explores the history and future of explicitly systems oriented design methodologies (Broadbent, 2003).
- Jones exploration of the systems inspired techniques of dialogic design to develop organizational strategies and processes and to take action (P. H. Jones, Christakis, & Flanagan, 2007).
- Andriani and McKelvey explore from a management and organizational perspective a key point made by Taleb: the importance to understanding and decision making of determining if the context of the situation is one of the Gaussian world "mediocrastan" or the Peretian world "extremistan" (Andriani & McKelvey, 2009; Taleb, 2007).

As another example of how the elaboration of these ideas continues: At the interdisciplinary focused 2011 55th conference of the ISSS entitled "All Together Now: Working Across Disciplines" one of Churchman's former PhD students, John

Pourdenhnad and others, presented a paper entitled "Systems & Design Thinking: A Conceptual Framework for Their Integration" (Pourdehnad, Wexler, & Wilson, 2011a; Pourdehnad, Wexler, & Wilson, 2011b).

Finally, and most recently, David Ing, in his opening address at the 56th conference of the ISSS entitled "Service Systems, Natural Systems" in his role as the 2011-12 President of the Society provided an overview of current trends in the field of systems oriented organizational research, including the critical role of design (Ing, 2012). Ing also lead a workshop entitled "Human Systems are Different: Andras Angyl via Eric Trist" recalling, for the newer members of the community, one of the very early (1941) contributions to the literature by Andras Angyl[73] concerning the difference between human (purposeful) and non-human systems (Ing & Hawk, 2012; Trist, 1992).

At the same conference Jones presented a paper "Toward the Integration of Visual Languages for Systems Design" recalling the exemplar ontology researchers' conclusions that visual thinking is important in design (under 3.5.1.3), but explicitly linking this to systemic design (P. H. Jones, 2012).

A Brief Introduction to Soft Design Science Methodology

Exploring the latest work at the intersection of (soft) systems methodology and design science by Baskerville et. al. reveals the details of the current understanding of the proximity or affinity of these two epistemological approaches. This is shown in Figure 3-13.

[72] Support for this assertion can be found in 3.5.3.1.
[73] Angyal, Andras. 1941. Foundations for a Science of Personality. The Commonwealth Fund.

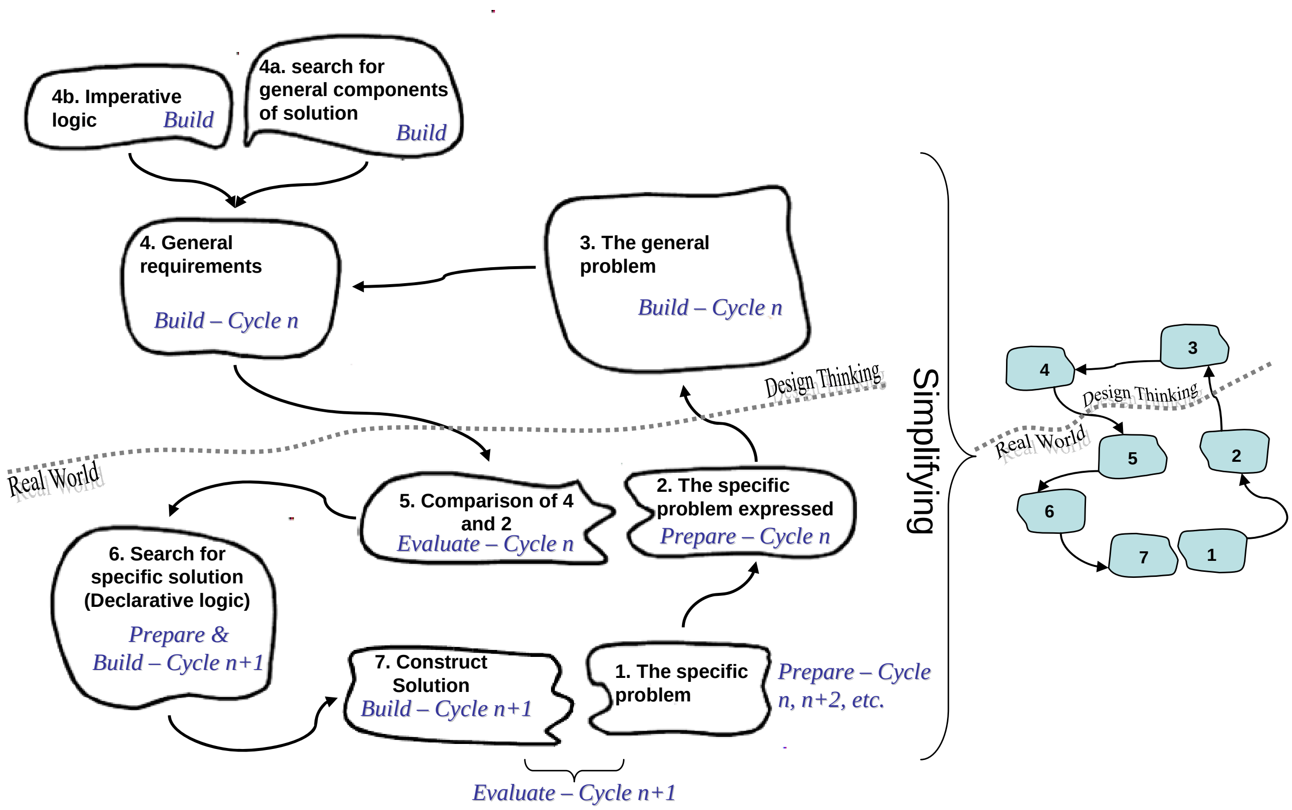


Figure 3-13: Soft Design Science Methodology (SDM)
(Adapted from Baskerville et al., 2009, Fig.5 p.5)
(Black san-serif text label SDM steps;
blue serif italic text label design science activity streams)

On the left of Figure 3-13, labelled 1 thru 7 in a san-serif font is Baskerville et. al's extension / adaptation of Checkland's original Soft Systems Methodology (M. C. Jackson, 2000, p.246-269) to explicitly accommodate the requirements of a Design Science approach. This process is simplified on the right of the figure, and this simplification will be used a visual cue in later figures (e.g. Figure 3-18).

The design science activity streams prepare, build and evaluate are shown in a blue italic serif font in relation to each of the steps of the proposed Soft Design Science Methodology (SDM).

Comparing the SDM steps to the design science activity streams shows how for each cycle of the SDM (steps 1 thru 7) there are two complete cycles of the design science activity streams. For illustration two design science cycles are labelled as n and n+1, with the first prepare activity stream in a third cycle being labelled as n+2.

Hence the design science prepare, build and evaluation (comparison) activity streams occur twice in each SDM cycle. The first occurrence of the three activity streams occurs in SDM steps 1 thru 5. The second in steps 6 thru 1 (of the subsequent iteration of the SDM cycle).

Focusing on the evaluation activity stream: the first occurrence is during the comparison of the general requirements with the expression of the specific problem (SDM Step 5). The second occurrence of the evaluation activity stream bridges from the SDM construct solution (step 7) to the (assumed) new specific problem situation created by the introduction of that solution (Step 1 of the second SDM cycle).

The purpose of these two evaluation activities is different in terms of the design science research output elements being evaluated (see Table 3-5). Hence the type of knowledge about the problem being used to conduct the evaluation and the potential sources of that knowledge will also need to vary to maximize rigor and output legitimacy[74, 75].

The Proximity of Design Science and Systems Thinking

From this latest methodological research, the proximity of design science and systems thinking, what might be termed systemic design science, might be summarized as follows:

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[74] This web page from a course at Southern Cross University and the Southern Cross Institute of Action Research in New South Wales Australia shows how SSM "comparison" step is clearly the same as design science evaluation - (Dick, 2002) Further the 4 dialectical steps of SSM gives support for the idea of evaluation fitting in two places in each cycle.

[75] This description ignores the comparison activity which takes place in SDM steps 3 and 4, i.e. the first occurrence of the design science build activity stream. This important aspect of evaluation will be explored in the detailed design of the build activity (5.2.5.5).

1. A common desire to produce an improvement in the world. Design science attempts this via the build/evaluation of an artefact. Soft systems methods attempt this via planned action based on understanding a problem, modelling the problem and potential solutions, and comparison of these with the real world problem at hand.
2. The high degree of alignment of the notions of constructs, models and instantiations in design science with the notions of root definitions, models and solution construction in Soft Systems research.
3. A common conceptualization of: the design science evaluation to test utility of the constructs, models and instantiations in artefacts, and the soft systems methodology comparison of root definitions and models to the 'real-world' problem, and the subsequent comparison of the implemented solution with a reduction in the scope or impact of the 'real-world' problem.

3.5.2.3 Rigor in Organizational Sustainability Research

Before proceeding to reflect on the literature on design science organizational research and systems oriented organizational research to determine how best to achieve research rigour, a third perspective needs to be considered.

Despite all the literature reviewed above the sustainability problem domain provides some additional challenges not addressed by the design, systems or the emerging integrated systemic design science approaches to organizational research.

It is widely recognized that sustainability is an emergent property of a system of systems – including the focal system under study (i.e. the organization) (T. F. H. Allen et al., 1999; Marcus et al., 2010; Meadows, Meadows, Randers, & Behrens, 1972; Schwaninger, 2008). Hence it would seem advisable to consider whether using formal scientific systems approaches would make the study of organizations as holons[76] and their necessary relations to their systemic contexts and the emergent property of sustainability more tractable.

But, while as discussed above, systems thinking may inherently involve design; there is nothing inherently systemic about the design approach. Notice how Baskerville et. al. add design science to Soft Systems Methodology to create a Soft (Systems) Design Method and not the other way around (Figure 3-13). This observation applies equally to understanding the problem / solution domains (prepare activity stream), and the process of artefact design (the build and evaluation activity streams) (Pourdehnad, Wexler, & Wilson, 2011b, p.9).

3.5.2.4 The Challenges of Ensuring Rigor in Design Science Organizational Sustainability Research

In response to challenge two, how to ensure rigor in this research, a question was posed: whether the literature on design science alone was necessary and sufficient (3.5.2). The short answer was no. So, to further explore this question, a search of the systems approach to organizational and sustainable organization research was presented including the relationship of the systems thinking epistemology to the chosen epistemological approach (design science and information systems ontologies).

Reflecting upon Challenge Two (3.5), how to achieve rigour in light of this body of literature and the objective of this research, this challenge can be understood as a gap in the literature between:

- The design science advice on rigour (introduced in 3.4 and explored in 3.4.7, 3.4.9 and 3.5.1),
- The advice on rigor from systems oriented organizational research, which necessarily includes the process of design (3.5.2.2), and

[76] Arthur Koestler coined the term holon for something which is simultaneously a whole and a part (Koestler, 1967, pp.47-48), a key systems thinking idea. This thesis assumes organizations are best understood as holons (noted in 2.5 Axiom #8) – consisting of many parts (some of which may also be understood as whole systems) and simultaneously being a part of many larger systems (e.g. the economy, society and the biosphere). The recent work by Marcus et. al. discusses the applicability of holonic thinking to organizational sustainability research in detail (Marcus, Kurucz, & Colbert, 2010, p.402 & pp.427-428).

- The lack of a body of work on how to achieve rigour in systems oriented organizational sustainability research (3.5.2.3).

Understanding Challenge Two as a gap in the literature allows a path to an acceptable response for this research design to be observed: the integration of systems and design understanding of organizational sustainability and the related epistemological processes: i.e. the creation of a systemic design sciences approach for this research.

In turn this path allows a useful restatement of Challenge Two:

> **Challenge Two:** how to rigorsly undertake this organizational sustainability design science research by taking an ***appropriately systemic approach***, and hence ensure legitimacy of its designed artefact?

Earlier, design science was identified as comprising four activity streams (prepare, build, evaluate, communicate). From systems thinking we can see that these activity streams are ***parts*** of a designed ideal-seeking purposeful system of inquiry[77]. The function of this ideal-seeking purposeful system is to create the 'best' artefact, i.e. one with high utility in respect to the research purpose.

[77] Recalling the three step process introduced at the start of this Part (Figure II-1) that are being applied systematically to ensure rigour in the design of this research: With the above introduction to systems thinking in mind, this three step process might now be labelled, after Ackoff, a designed ideal-seeking purposeful system of inquiry whose goal is to undertake this research, its design and its subsequent execution, with the 'best' rigour possible.

This first designed ideal-seeking purposeful system was used to design a second ideal-seeking purposeful system. This second system is shown in the three iterations of the three steps in Figure II-2. The first two iterations are designed to rigorously produce the 'best' overall and detailed research design. The third iteration rigorously executes the research design. (Figure 3-1 shows the first iteration of the three steps which outputs the overall research design, this chapter).

The third iteration of the three steps, the execution of the research design, may be also considered a third designed Ideal-Seeking Purposeful System of Inquiry created by the first two iterations. This second system has the different goal to rigorsly create the 'best' Strongly Sustainable Business Model Ontology and Canvas (the artefacts output from this second system of inquiry).

This thesis records the process and output of all three of these ideal-seeking purposeful systems of inquiry (how this recording is achieved is also shown in Figure II-2).

This suggests that Challenge Two could be made more tractable by restating it in terms of the functions of these ***parts***. This allows a further clarification of Challenge Two as two sub-challenges. One for preparation: attempting to understand the problem domain, and one for prepare, build and evaluate: attempting to create a useful solution:

Challenge 2-1: How to best understand the organizational sustainability problem and solution domain given that organizations' and their contexts have a holonic relationship and that sustainability is an emergent property of this system of systems (***Prepare***)

Challenge 2-2: How to best undertake the creation of organizational sustainability artefacts given such problems can be solved more effectively if a systemic approach is used (***Prepare, Build and Evaluate***)

The next two sub-sections (3.5.3 and 3.5.4) will present two further searches of the literature, reflections on these two sub-challenges, and the application of this knowledge in light of the objective this research. This results at the end of each of these two sub-sections with the final two passes of the overall research design (pass three and four respectively).

While the approach developed to overcome challenge two is conceived in the context of research to develop a sustainable business model artefact, the literature review suggests the approach is likely applicable to any artefact related to organizational sustainability. This is because the two aspects of challenge two relate not to the nature of the artefact but to the nature of the problem (organizational sustainability) and the overall epistemology (systemic design science).

Given the lack of literature that provides specific advice on systemic approaches to design science sustainable organizational research the following is a methodological contribution of this research.

Terminology Used to Describe Key Theoretical Frames and This Research

Before proceeding, a word on terminology used to structure the following search of the literature, particularly in respect to the sociologic and economic fields.

Term	Definition
Macro-<field>	Study of the context for an organization, e.g. macro-economic, and macro-sociology.
Micro-<field>	Study of the organization and its containing parts e.g. micro-sociological and micro-economics (as sub-disciplines of the organization and management key theoretical frame).
Neo-classical <field>[78]	Study of organizations or their contexts without an explicit systems approach, e.g. neo-classical economics or sociology.
Ecological <field>	Study of organizations and their contexts with an explicit systems approach, e.g. ecological economics, sociology, organizational sustainability.

Where <field> may be economics, sociology, etc.

Table 3-9: Terminology Used to Describe Key Theoretical Frames

As one concrete example of the use of this terminology:

> The term for the field of this research is "ecological organizational sustainability", "ecological micro-sociology" and / or "ecological micro-economics".

[78] The word 'neo' is used because most early (i.e. machine age, but pre-industrial revolution) sociology and economic scholars appear more interested in the context of their fields of study, up to and including the biosphere than the majority of more recent and hence "neo" scholars. Perhaps this is a result of the more immediate day-to-day reliance these early scholars had on life-sustaining solar energy and the resulting output of plants and animals.

3.5.3 Challenge 2-1: Systemic Key Theoretical Frames

Applying systems thinking to Challenge 2-1 seems an appropriate way of critically reflecting to determine a path to an acceptable response to Challenge 2-1.

Ackoff (1974, p.3) suggests a (the) critical element of systems thinking is the integrated use of:

> **Synthesis**: asking what contains the whole (system under inquiry)?
>
> …while simultaneously and reflexively using…
>
> **Analysis**: asking what (parts) does the whole (system under inquiry) contain?

Considering the research design process as an ideal-seeking purposeful system of inquiry and applying synthesis and analysis with the research objective in mind, leads to two perspectives to challenge 2-1:

1. What contains the whole (system) of a sustainable organization? (***Synthesis***)
2. What (parts) does the whole (system) of a sustainable organization contain? (***Analysis***)

Considering these perspectives enables a useful clarification of challenge 2-1:

> **Challenge 2-1a:** How to best understand the context of organizations systemically (synthesis)?
>
> **Challenge 2-1b:** How to best understand the parts of organizations systemically (analysis)?

The next headings (3.5.3.1 & 3.5.3.2) search the literature with each of these two perspectives in mind. The following headings (3.5.3.3-3.5.3.5) reflect on and apply the results of the search leading to a response to challenge 2-1 and the third pass of the research design (Figure 3-14).

3.5.3.1 Understanding Organizations' Context Systemically (Challenge 2-1a – synthesis)

What literature is available to organizational sustainability researchers looking to understand the context of organizations, their containing holons, in the sustainability problem and solution domains? Under this heading the results are presented of a search of the literature to find that portion which takes a systemic view of organizations' containing wholes: the nested system of systems comprising the biosphere, human society and the monetary economy.

In support of this synthetic analysis related to organizations and sustainability: Ackoff writing from the organizational perspective (Ackoff, 1971) and other systems scholars such as Ozbekan and his Global Problématique, appear to have influenced the work of the Brundland Commission (WCED, 1987). "Our Common Future" takes the position that it is not possible to understand what sustainability means to a given system without taking into account the containing system and the parts of the system under study.

A small amount of literature that explicitly considers this perspective has already been introduced to provide an introduction to the concept of sustainability (under 3.4.6.1). What other literature is available to organizational sustainability researchers looking to understand the systemic context of their problem and solution domains?

> *Key Theoretical Frames for Ecological Organizational Sustainability Research: Ecological / Systems Conceptions of Organizations' Context*
>
> Given the timing of the development of the systems world-view of organizations (introduced in 3.5.2.2), it is to be expected that there would also be a rich tradition in natural and social science research, also stretching back to the 1940's, of applying the formal science of systems.
>
> An initial scan of the literature which takes an explicitly systems approach to understanding each of the three major containing systems relevant to ecological organizational sustainability yields the following:
>
> - ***Natural Sciences*** (physical, chemical, biological, ecological). There is considerable amount of literature examining the biosphere from a systems

perspective e.g. the “paradigm”[79] creating general systems theory (Bertalanffy, 1968) and chaos theory (Gleick, 1988, 1987) and many subsequent works of “normal science”.

From this work, recalling Ackoff’s systems typology (3.5.2.2), planet Earth, the critical life enabling context for the biosphere (and hence humans and their organizations), is considered a semi-open system; i.e. in general energy may move to and from the Earth’s context (space containing our nearest star) but matter may not.

The implications of this characterization of the Earth as a semi-open system in relation to its context are the subject of current natural science research relevant to sustainability organizational researchers. This research is starting to:

– Understand the likely tipping points for the major planet-spanning life sustaining biophysical processes: attempting to model what level of anthropomorphic disruption would cause these processes to flip to different attractors and the level of consequent disruption to human and other life (Rockström, 2009; Rockström & et. al., 2009).

– Refine the definition and understanding of the Earth as an open system. The understanding of Earth as a self-organizing holarchic open system (labelled “SOHO”) and the implications of the 2nd law of thermodynamics as root of common generative and evaluative processes that lead to life and human society (labelled Non-Equilibrium Thermodynamics, NET) (T. F. H. Allen et al., 1999; T. F. H. Allen, 2003; Kay, 2000; Minkel, 2002; E. D. Schneider & Kay, 1994; E. D. Schneider & Sagan, 2006; Vedral, 2012)[80].

– Explore systems / complexity views of the ecology of the biosphere, its interaction with the lithosphere and its containing context, the solar system

[79] Term used as per Kuhn’s seminal “Structure of Scientific Revolutions”. (Kuhn, 1996)
[80] Some of this thinking is considered controversial by some researchers. As one criticism see Corning & Kline (1998a; 1998b).

(Eriksson & Robèrt, 1991; Ulrich, 1993; Waltner-Toews, Kay, & Lister, 2008).

Finally there are those natural scientists who are attempting to directly apply their physical, chemical, biological and ecological knowledge to societal problems related to sustainability, often taking an explicit design approach.

These authors might be considered to be the 'best' ecological micro-sociologists and ecological micro-economists today because they start from the biophysical and work 'up' to the social[81]. Their starting point means they remain fully aware of the context of their social or economic theorizing. Hence they are more likely to ensure such theorizing is 'compatible' with the latest natural and formal scientific knowledge.

These 'biophysically inspired ecological micro-sociologists' include:

– Benyus, whose concept of biomimicry asks how the efficiency and effectiveness of biological 'design' can be used to inspire human artefacts (physical and conceptual) to achieve levels of material and energy efficiency and effectiveness similar to the high levels generally found in nature whilst producing only waste which is assimilatable by the biosphere (Benyus, 2002; Blend, 2007).

– Stahel, Braungart, and others have introduced a set of (mainly) product and service design principles that might be labelled "Cradle to Cradle" thinking, and which are aligned in many respects to the biomimicry idea (Braungart, 1994; McDonough & Braungart, 1998; McDonough & Braungart, 2002; Stahel, 1994; Stahel, 1998)

– The work of Kay, Regier, Boyle and Francis provide advice to managers on decision frameworks along with a process for its application, given the complexity of organization's containing ecosystems (Kay, Regier, Boyle, & Francis, 1999)

– Robért and others have introduced a set of organization, product and service design principles and implementation methodologies which are known collectively as Framework for Strategic Sustainable Development (FSSD) as well as a global NGO The Natural Step (TNS)[82] to promulgate these ideas (Broman, Holmberg, & Robèrt, 2000; Eriksson & Robèrt, 1991; Holmberg & Robèrt, 2000; Nattrass, 1999; Robèrt et al., 2002; Robèrt, 2002)[83].

– Ehrenfeld and others have introduced a set of ecological industrial organization design principles, along with an exploration of their product and service implications and constraints, which are known collectively as Industrial Ecology (Allenby, 2006; Bansal & McKnight, 2009; Chertow & Ehrenfeld, 2012; Cohen-Rosenthal, 2003; Côté, Grant, Weller, Zhu, & Towes, 2006; Davis, Nikolic, & Dijkema, 2010; Ehrenfeld, 2008).

– Allen, Tainter and Hoekstra (introduced under 3.4.6.1) suggest that all management is applied ecology; based on the analogy that engineering is an applied natural science (physics, chemistry or biology). Hence these authors' provide considerable advice to managers related to how to understand ecological organizational sustainability and the options on how to achieve it given the limitations on organizations imposed by their holonic contexts (Ahl & Allen, 1996; T. F. H. Allen et al., 1999; T. F. H. Allen, 2003; Tainter, 1988; Tainter, 2000; Tainter, 2003; Tainter, 2006).

– Mitchell looks at how the definition of "legitimate science" is changing, specifically in-light of the findings from systems and complexity theory, and suggests how this new conception of science might impact public policy and process (Mitchell, 2009).

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[81] See the critique of neo-classical sociology and economics presented below for justification of this assertion.
[82] The Natural Step's global website is http://www.naturalstep.org/
[83] There has been some critique of research which underpins the FSSD (Upham, 2000), although the recent publication by Rockström et. al. tend to blunt the largest concerns raised (Rockström, 2009; Rockström & et. al., 2009).

- ***Macro-Sociology***. Less sociological work examining society using a system lens exists. Understandably much of the work that does exists has come from a very small group of self-described "environmental sociologists" (Barkow, 2006; Catton & Dunlap, 1978). For consistency this perspective will be referred to as ecological sociology following the terminology introduced in Table 3-9[84].

  These few ecological macro-sociological scholars reject the majority neo-classical and hence context free, definition of macro-sociology as the self-referential, "study of sociological facts" (Durkheim, 1982, translations of works written 1895-1917)[85].

  Despite the considerable body of micro-sociological work introduced earlier which take a systems approach to understanding organizations (3.5.2.2), these works do not represent the majority who take a distinctly neo-classical view of micro-sociology. Hence the situation is similar for micro-sociological knowledge as it is in macro-sociology. The systems approaches are in the distinct minority, with the situation perhaps being particularly acute in the micro-sociological fields of organization and management.

  This is because these fields appear almost universally to take the predominant neo-classical macro-sociological key theoretical frame as the base for their theorizing. Further ecological micro-sociology must necessarily be a sub-set of the already limited field of ecological macro-sociology: not a situation likely to create rewarding academic careers for budding ecological micro-sociologists. One might refer to such situations, which are common in all fields of sustainability (practical and academic) as "locked-in"[86] – in this case due to Durkheim's neo-classical context free conception of sociology and its subsequent macro and micro operationalization.

[84] Despite this attempt as termological consistency it should be noted that much, perhaps even a majority, of the work in the environmental sociology field would not meet all aspects of the systemic world-view.
[85] Durkhein is widely considered the founder of neo-classical macro-sociology.
[86] Concept of lock-in and is application to aspects of sustainability is developed by Unruh (Unruh, 2000)

Upon reflection this state of affairs is unsurprising given the lack of interest shown by both macro and micro sociologist in ensuring their work remains "compatible" with the increasingly systems oriented natural science knowledge cited above:

> *A biologist who described processes incompatible with chemistry or a chemist who claimed to have discovered reactions that violated the laws of physics would be considered a crank.*
>
> *[In other words the natural sciences follow a 'compatibility' rule - but social sciences have historically tended not to, instead mistaking] the changes in fashion [for progress in knowing].*
>
> *Unlike natural scientists social and behavioural theorists typically ignore explanations at others levels of organization or worse treat them as competitors. […] What evolutionists are asking is only that sociology and social-cultural anthropological accounts be compatible with what we think we know of human evolution and psychology: that is all.* (Barkow, 2006, p.29).

Ecological organizational sustainability researchers, who are by definition ecological micro-sociologists, and despite neo-classical normal science barriers, must take the ecological macro-sociological key theoretical frame as their starting point. Hence these researchers, and indeed this research, have a limited range of applicable ecological macro- and micro-sociological key-theoretical frames to draw upon.

However a limited range is not none. Some scholars are undertaking ecological macro-sociology research applicable to ecological organizational sustainability research. These scholars reject the neo-classical Durkheimian view of sociology and reconceive an ecological macro-sociology as one which includes the contextual systems of the biosphere and all the implications of systems thinking, complexity and risk theory.

Within ecological macro-sociology[87] there are a number of systems oriented sociological theories relevant to ecological organizational sustainability including

– Reflexive modernization (Beck et al., 2003; Law & Urry, 2004).

– Transition management (Geels, 2010).

– Post-pluralistic conceptions of for-profit business (Blattberg, 2000; Burns, 2000; Law & Urry, 2004, Footnote 47; Pojasek, 2009; W. Young & Tilley, 2006).

– Approaches to historical (anthropological and archaeological) research (Diamond, 2005; Ferguson, 2008; Morris, 2010; Ponting, 1992; Tainter, 1988, who explicitly discusses complexity in a historical context).

– Nobel prize winning (in Economics) political scientist Ostrom who developed and evaluated a wide range of organizational and institutional design principles for the sustainable management of common pool resources (Ostrom, 2008; Ostrom, 2010). Her works disprove the earlier, but still wide-spread assertion, that commons are necessarily and always tragedies (Hardin, 1968).

- ***Macro-Economics***. In macro-economics the situation appears somewhat better than macro-sociology, in terms of the number of researchers actively taking the ecological rather than the neo-classical stance.

  Since the late 1960's the field of ecological economics has been actively contributing to our understanding of the economy as a sub-system of the socio-bio-geo-physical. While ecological economics, like ecological sociology remains a minority, the influence and subsequent adoption of their ideas by mainstream (formally) neo-classical economists appears to be starting (Stern, 2006; Stiglitz,

[87] Other examples of works in the field that organizational sustainability researchers may find of interest, and this researcher found necessary as context for this research, are: (Barkow, 2006; Beck, 1992; Beck, 1992; Beck, Bonss, & Lau, 2003; Bernstein, 1996; Brewster & Bell, 2010; Crossley, 2008; Dickens, 2001; Freudenburg, 1993; Freudenburg, 2000; Gladwell, 2000; Hannigan, 2006b; Holifield, 2009; S. Johnson, 2002; Law & Urry, 2004; Murphy, 2002; Perrow, 1984; Ponting, 1992; Taleb, 2007; van Loon, 2002a; van Loon, 2002b).

Sen, & Fitoussi, 2009); although this has not been without criticism from neo-classicalists (See a radio debate between two ecological and two neo-classical economists Kennedy, 2011; Nordhaus, Stavins, & Weitzman, 1992; Sacks, Stevenson, & Wolfers, 2010).

Ecological macro-economists, like ecological macro-sociologists, also reject the context free definition of their field. Neo-classical economists define economics as the study of the system of firms and households largely without reference to its containing whole[88]. Ecological economists reject this self-referential and closed view, in favour of including the contextual systems of society and the biosphere (Boulding, 1966; Daly, 1973; Georgescu-Roegen, 1975; Pearce, 2002; Schumacher, 1973; Vermeij, 2004). Further, ecological economists take on board as a first order of business the need for their theorizing to be compatible with current natural science. Most prominently for ecological economists this requires their theorizing to respect the constraints imposed by the 2nd law of thermodynamics and the law of conservation of matter (Georgescu-Roegen, 1975; Hammond & Winnett, 2009; J. T. Young, 1983).

Reviewing the ecological macro-economics literature reveals much theorizing of relevance to ecological organizational sustainability research including:

– Understanding complexity in the context of economy and its holonic contexts (Holling, 2001)

– Understanding the limitations on the scale of the macro-economy given the limitations imposed by the biophysical (Lawn, 2001; Lawn, 2004; Schor, 2010).

– Understanding the needs of humans and the connections between per capita income and consumption habits in order to sustain and enable improved human flourishing and ensure the wide-spread sustainability of human

[88]Natural resource and environmental economists, although fundamentally neo-classical in stance, do include some consideration for the containing whole, although these amount to tinkering rather than the re-conceptualization undertaken by ecological economists.

societies (BBC, 2010; Beder, 2004; Binswanger, 2006; Csikszentmihalyi, 2000; Easterlin, 2001; Helliwell, Barrington-Leigh, Harris, & Huang, 2009; Layard, 2003; Layard, 2006; Lintott, 1998; Organization for Economic Co-operation and Development (OECD): Social Directorate, 2008)

– Understanding the impact on ecological macro-economic goals of sustainability of micro-economic improvements in efficiency (Sorrell, 2007)[89]

– Understanding the impact on ecological macro-economic goals of international trade policy and trade (Giljum & Eisenmenger, 2004; Neumayer, 2000)[90].

– Policies to create the macro-economic conditions required for ecological organizational sustainability (Daly, 2002; T. Jackson et al., 2011; Lawn, 2001; Lawn, 2004; O'Neill, Dietz, & Jones, 2010; Victor, 2008)

– Understanding, exploring and critiquing the definition of sustainability from the economic perspective introducing the concepts of "no-growth" economies, and "weak" vs. "strong" sustainability (more on this below) (Brinkman, 1995; Daly, 1973; Kennedy, 2011; Kerschner, 2010; Lawn, 2010; Lawn, 2011; Max-Neef, 2010; Neumayer, 2010; F. Schneider, Kallis, & Martinez-Alier, 2010; Victor, 2008; Victor, 2010; Woodward & Simms, 2006).

[89] The Jevon's paradox otherwise known as the rebound effect

[90] Margaret Thatcher famously said "There Is No Alternative" but to maintain the historical approach to generating flourishing via GDP growth (usually via lowering trade barriers to international trade); this perspective is often labeled as "TINA".

But alternative has been proposed "Local Ownership, Import Substituting" that includes social as well as economic aspects to creating flourishing. This perspective is often labeled as "LOIS", and used in sentences such as "The alternative to TINA is LOIS"! (Shuman, 2005)

LOIS is being actively operationalized at the grassroots level by organizations in the U.K. such as The Transition Towns Movement, in the U.S. such as the Business Alliance for Local Living Economies (BALLE); crossing the boarder with both US and Canadian presence are Benefit Corporations (B-Labs) (B Lab, 2008; Richardson, 2010) including the MaRS Centre for Impact Investing Certified B-Corporation Hub), Blue-Green Alliances, Impact Investing (B Lab, 2010b; B Lab, 2010c; GIIN, 2009a; GIIN, 2009b; GIIN, 2010a; GIIN, 2010b; K. Jones, 2009; Krogh, 2010), the various Stewardship Councils which have been created over the past 15 years, e.g. for Forests and Fisheries, etc. In the Toronto region notable examples include: GreenTBiz, Canada's largest eco-business zone Partners in Project Green, and the ground breaking although and recently re-launched Green Enterprise Toronto, see this video (Lowry, 2008) and http://greenenterprisetoronto.com. In

– Designing the macro-economic measures of sustainability (El Serafy, 2006; Jollands, 2006; Lawn, 2006a; Lawn, 2006b; Lawn, 2006c; Lawn, 2006d; Lintott, 2006; Norgaard, 1990; Patterson, 2006; Peet, 2006; Tideman, 2011; van den Bergh & Verbruggen, 1999).

– Ecological macro-economics also provides examples of direct application of systems techniques to economic study, including systems modelling of economies and their relationships with society and the biosphere (Boumans et al., 2002; Costanza & Ruth, 1998; Meadows, 2005; Nørgård, Peet, & Ragnarsdóttir, 2010; Turner, 2008; Victor, 2008).

While ecological economists are almost all focused on the macro, a few works focusing on the micro-economic were also located by these scholars:

– Understanding indicators of sustainable development for firms (Callens & Tyteca, 1999)

- ***Psycho and physio-social.*** As mentioned above, ecological economists such as Layard, have taken a direct interest in the underlying teleological purposes for the economy: increasing human flourishing (aka happiness). Indeed this is the stated purpose of all economics – neo-classical and ecological.

  Ecological economists are however building on the growing body of work in the fields of (neuro) physiology and (neuro) psychology about the antecedents and processes of flourishing and happiness (and indeed consciousness itself) (Doidge, 2007; McGilchrist, 2009 are examples that review the new neurological knowlede and use this to provide a view on human history).

  Of specific note for ecological organizational sustainability researchers is ecological psycho- and physio-social work: i.e. the application of the findings of physiology and psychology to the macro- and micro-social world as constrained

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Canada generally, organizations such as LocalFoodPlus, The Centre for Social Innovation (CSI) and the huge number of organizations hosted by CSI are also all examples which include some or all of the LOIS principles.

by ecological thinking (i.e. within the holonic context of the social). These works include those by:

- Hershey and others concerning the impact on human (mental and physical) health of hyper-materialism (H. H. Friedman & Linda, 2011).
- Doppelt, introduced earlier (3.4.6.1), and others explores the necessary world-views required by a majority of citizens for societies (and the organizations within them) to adopt the ecological micro- and macro- social and economic policies and design principles introduced above (Doppelt, 2012; Haidt, 2006; Harris, 2010; Harris, 2012; Kabat-Zinn, 2005).
- Macy, also introduced earlier (3.4.6.1), along with Senge and Goleman (as but three of many examples) explore the necessary mental frameworks and associated personal and organizational design (planning / strategizing) processes required to successfully undertake the combined world-view and redesign work which all the biophysical, social and economic authors above suggest is required to sustainably increase human flourishing (M. Brown & Macy, 2004; Goleman, 2010; Macy & Johnstone, 2012; Scharmer, 2007; Senge et al., 2005; Senge, Smith, Kruschwitz, Laur, & Schley, 2008). The alignment of these methodological works to the systems inspired organizational methods of Ackoff ("Interactive Planning") and Pourdenhead ("Integrated Planning" inspired by Churchman) appears significant.

Introducing Strong vs. Weak Sustainability

Ecological economists seeking to characterize in practical terms the differences arising from their reconceptualization of the discipline of economics within its holonic contexts needed to define "sustainability" and contrast this to the majority usage of the same term by neo-classical researchers and practitioners.

To do this they introduced the concepts of "weak" and "strong" sustainability (Ayres, van den Bergh, & Gowdy, 1998; Ayres, 2008; Neumayer, 2010 who, unless otherwise stated, are the sources for the following discussion).

Strong sustainability is defined in relationship to natural capital. Natural capital is the economic conceptualization of all the elements of the biosphere required to enable life to flourish. Strong sustainability then is the impossibility of replacing "back-stop" natural capital with any other kind: human, intellectual, manufactured, social or financial. Back-stop natural capital refers to a type of natural capital for which there appears to be no possible substitution of any other sort of capital – i.e. no technological fix. [91] This is felt to be particularly true in time frames that might help mitigate the worst effects of climate change and other anthropomorphic impacts.

But this discussion is at the macro-economic level – the level of the planet and societies. What about at the micro-economic or organizational level? We know that it is the action of humans within human organizations that play a very significant part of achieving or failing to create flourishing. Hence achieving strong sustainability would appear to imply that at the organizational level environmental, social and monetary goals must be integrated – otherwise (short-term) monetary objectives may (will / do) override concerns for natural capital (Blattberg, 2000)[92].

Strong sustainability can also be defined in comparison to the "weak sustainability" as suggested by neo-classical macro-economists. Weak sustainability assumes that all natural capital can be replaced by human, manufactured, social or financial capital. This assumes that a natural capital which is depleted can be replaced using human technology, and that pricing signals will cause the appropriate / necessary technology to arise "just in time" for significant suffering to be avoided.

Weak sustainability is often labeled "sustainable development", as defined by the 1987 Brundland Commission Report (WCED, 1987). Brundtland suggested that flourishing will result from sustainable development: i.e. development that meets the

[91] Usually the impossibility of substitution is due to the realities imposed on the other capitals by the laws of conservation of mass and energy (i.e. laws of thermodynamics).

[92] That there is only one citation to support this assertion gives a sense of the practical impact on ecological micro-sociologists of the neo-classical macro- and micro-sociological majorities' lack of interest in ensuring their works are compatible with the latest natural science and ecological macro-economics. Hence, making this assertion may also be a contribution.

needs of the present without compromising the ability for future generations to meet their needs.

John Ehrenfeld arguing from the strong sustainability standpoint states:

Sustainable development is not a vision for the future[93]. *It is merely the modification of the current process of economic development. […] Sustainable development is fundamentally a tool which suggests new means but old ends. […] Unsustainability is an unintended consequence of the addictive patterns of modern life. Almost every thing being done in the name of sustainable development addresses and attempts to reduce unsustainability. But reducing the unsustainability, although critical, does not and will not create sustainability* (Ehrenfeld, 2008, pp.5-7).

Hence Ehrenfeld suggests the Brundtland's combination of "sustainable" and "development" and thus weak sustainability is oxymoronic; putting these two words together is at best unhelpful and at worst damaging to the achievement of flourishing.

To conclude this introduction to weak vs. strong sustainability: the latest review of the weak vs. strong sustainability argument (conduced by an ecological economist) concluded that neither position is supportable empirically, since as noted earlier, definitions of sustainability hinge on the forever mutable personal world-views / value systems and the mutable state of the biosphere. Neumayer states:

[We have] tried to assess the viability of the opposing claims of weak and strong sustainability with respect to the substitutability of natural capital. The conclusion that arises from the analysis is that both paradigms rest on certain assumptions as well as hypotheses and claims about the (distant) future [peoples' values and what people value in that future] that are non-falsifiable (Neumayer, 2010, p.89).

However, other arguments in favour of strong vs. weak sustainability have been made by natural scientists, ecological macro-sociologists and macro-economists (see works

[93] Ehrenfeld contrasts the Brundtland definition of sustainability development as a vision statement to Martin Luther King Jr.'s "I have a dream" speech which in Ehrenfeld's view "foresaw a whole new world".

cited under natural science, ecological macro-sociology, and ecological macro-economics above for support for this synthesis of their arguments and evidence).

In the now famous statement, Einstein suggested that new paradigms are required to solve problems created by old paradigms. This would suggest that following the old-paradigm advice of neo-classical macro-economists is unlikely to solve the Global Problématique that has arisen as a result of pursuing that paradigm. In other words, applying Einstein's assertion: it is unlikely that widespread human flourishing[94] will be produced by largely relying on technology (i.e. manufactured, social and financial capital) produced within a system of economic development which has as a singular goal maximizing per capita GDP growth[95].

Building on this perspective, a singularly technologically focused strategy (i.e. making weak sustainability the goal) appears all the more risky when one considers the ever growing body natural science knowledge identifying major and growing risks to human flourishing (not to mention the flourishing of other life).

A more balanced approach, suggested by ecological economists is still concerned with maximizing human creativity and hence innovation driven economic activity. But the ecological economic approach suggests it is prudent and less risky to do so in ways that recognize the fundamental limits of the biosphere and a direct societal goal of maximizing flourishing rather than maximizing GDP per capita.

Although it is clear that there is a strong connection between the proxy of monetary per capita GDP and flourishing, ecological economic, psycho and physio-social researchers now understand that this connection has distinct limits. These limits were

[94] Recalling Ehrenfeld's definition of sustainability "The possibility that human and other life will flourish on this planet forever" (Ehrenfeld, 2008, p.6) (Introduced in 3.4.6.1)

[95] See 4.5.4 for detail. For now note that even the 1930's originator of GDP understood that GDP was not a measure of human flourishing "...the welfare of a nation can […] scarcely be inferred from a measure of national income..." (Kuznets, 1934, p.7)

Neo-classical economists (i.e. the current main-stream majority), continue argue that maximizing GDP over-time, based on models of the economy consisting only of firms and households, remains both necessary **and** sufficient to human flourishing.

This remains one of the single biggest points of disagreement between neo-classical and ecological macro-economists.

passed in the global North during the 1970s and hence while GDP per-capita has continued to grow measures of happiness or well-being have remained constant or declined (Further discussion and specific sources in Chapter 4).

The cumulative effect of the existing focus on GDP growth has not been without considerable problems. Add to this the impacts of the other elements of the Global Problématique: the identified risks from population size and growth, the almost exponential increase in natural capital depletion and the very short timeframes that natural science tells us we have to act to avoid the worst effects of current human activity. Considering all these factors together strongly suggests that the need for change is urgent and the current predominant neo-classical macro-economic paradigm appears an extremely risky 'bet the farm' approach.

In contrast, the ecological economics approach, while clearly not without risk, at least prudently suggests that all or nothing bets are not the way to go!

Refining Terminology Used to Describe Key Theoretical Frames and This Research

Earlier (Table 3-9) ecological organizational sustainability was introduced as a term to describe the field for this research. Having now introduced the concept of weak vs. strong sustainability this terminology can be improved (and simplified).

Weak sustainability is clearly a neo-classical macro-economic idea, and hence is by and large associated with the majority neo-classical micro-sociological research (i.e. neo-classical sustainability management and organization research). Using this improved terminology, hence forth this field of research is simply labelled "organizational sustainability". This portion of the key theoretical frames (K0) is likely to support the "profit-first" world-view (K0-PF).

Strong sustainability is clearly an ecological macro-economic idea, and hence is by and large associated with ecological micro-sociological research (i.e. ecological sustainability management and organizational research).

Hence forth, in this thesis, the label for the field of this research is "organizational strong sustainability" or simply "strong sustainability"[96].

This portion of the key theoretical frames (K0) is likely to support the "strong sustainability" world-view (K0-SS).

3.5.3.2 Understanding Organizations Systemically (Challenge 2-1b – analysis)

The above considered the literature which takes a systemic view of organizations and their containing contexts. What literature is available to organizational strong sustainability researchers looking to understand organizations and the parts they contain in the strong sustainability problem and solution domains (applying analysis). Under this heading the results are presented of a search of the literature that takes a systemic view of organizations and their contained parts.

Clearly the works used to introduce the systems epistemology to this research design within the context of the unfolding of the transition from the "machine age" to the "systems age" (1.2) are applicable (reviewed under 3.5.2.2 and 3.5.2.3).

This scholarship includes work taking a quantitative and qualitative approach in their applicability of systems thinking with respect to human organizations. In part these authors adopt systems due to their understanding of the limitations of the purely mechanistic, machine age, analytical approach.

But what of systems views of the parts of organizations that explicitly consider the strong sustainability of those organizations in their holonic contexts (monetary economy, society and biosphere)?

The works used to introduce organizational strong sustainability take a systemic approach to understanding organizations and their holonic contexts (3.4.6.1). These works observe that any definition of strong sustainability must include both facts (about the ever changing

[96] This replaces the term "ecological organizational sustainability", "ecological micro-sociology" or "ecological micro-economics" introduced in Table 3-9.

current state of the biosphere, society and the economy) and values (of the organization's stakeholders about their desired future state of the biosphere, society and the economy).

But there are other applicable works that it is helpful to introduce at this stage in order to ensure their perspective can inform rigour in this research design.

Key Theoretical Frames for Organizational Strong Sustainability Research: Ecological (Systemic) Conceptions of Organizations and Their Parts

- ***Micro-Sociology and Micro-Economics***: As noted the majority of organization and management sustainability scholars take the micro neo-classical sociological or economic stance, i.e. they are still predominantly (stuck) within machine age sociological and economic conceptions of sustainable development and weak sustainability[97].

  These researchers use neo-classical macro-sociological and macro-economic theorizations of sustainability such as ecological modernization (a social theory of sustainable development) and weak sustainability (an economic theory of sustainable development) which at best have not been confirmed "compatible" with current natural science (McCright & Dunlap, 2010; McLaughlin, 2012; Neumayer, 2010).

  As a result little if any of the literature consulted from the management and organizational key theoretical frames takes on board the ecological micro-social and micro-economic implications of the above natural science and ecological-social and economic knowledge (Millar, 2012).

  The works of a growing a number of biophysically inspired[98] ecological micro-sociologists and micro-economists are helpful to organizational strong

[97] One possible reason for the range of labels associated with sustainability in the literature (3.4.6.1) is that it is a first sign of the discomfort and difficulty neo-classical researchers have with the implications with the ever increasing body of ecologically oriented natural science knowledge on the risks of the weak sustainability perspective.

[98] i.e. these researchers received their original disciplinary training in the natural sciences before subsequently undertaking research in the micro-sociological field of management and organization.

sustainability research. (These works were introduced in 3.5.3.1 under "natural science" above).

However, there are examples of research conducted by researchers whose primary disciplinary training is within the micro-sociological and micro-economic fields who take an ecological stance (i.e. ecological management and organizational researchers). Hence these works are applicable to organizational strong sustainability research. Relevant works include those by:

– The noted organizational scholar on the purpose of business (C. B. Handy, 1991; 2002; 2008) . This work was further developed by management researcher Doig, who focused her 2003 PhD on a Delphi study to determine then current views of managers on the definition of ecological organizational sustainability (Doig, 2003; Doig, 2009). Others are also involved in looking at the current legal barriers in place which prevent corporate officers and members of boards of directors from acting on this research for fear of legal sanction from shareholders and other owners (Richardson, 2010; Rowe, 2001).

– Bloomberg Professor at Baruch College Andrew Gabor on the history of the systems view of business (Gabor, 2010).

– The management researchers Marcus, Kurucz and Colbert are of note for taking the ecological micro-sociological stance, and because these researchers critique the neo-classical stance from which several of them previously published.

  These authors explore conceptions in the extant neo-classical management literature of what they refer to as the "business-society-nature interface". This work explicitly considers how organizations and their parts should relate to their holonic contexts (Marcus et al., 2010)[99] Their conclusions align with the

[99] In support of the observations made above concerning the current state of "compatibility" of the majority of neo-classical organization and management scholarship this work includes a critique of the majority for failing to be "compatible" with the current natural and formal science knowledge and the small but growing body of

nested conception of the monetary economy entirely contained within and dependent on human social systems which are in turn entirely contained within and dependent on the biophysical systems as introduced earlier (3.3) by Porritt and Victor (2007, p.57; 2008, Fig.2.2).

– The recent work of practitioner Hutchins (Hutchins, 2012a; Hutchins, 2012b; Hutchins, 2012c; Upward, McDougall, & Hoeller, 2012) and UK MBA student Dargent (2011) explicitly use the biomimicry ideas of Benyus (introduced in 3.5.3.1) and explore their applicability to achieving sustainable business outcomes within its holonic context.

– The published work of the Lovins and others provides advice to managers and engineers on organization, product and service design to improve sustainability outcomes, approached explicitly from the organization and management fields (A. B. Lovins & Lovins, 1997; A. B. Lovins, Lovins, & Hawken, 1999; A. B. Lovins, 2011; H. L. Lovins, 2007; Senge, Seville, Lovins, & Lotspeich, 1999; Weizsäcker, 1997; Weizsäcker, 2009).

– The work of some management scholars who discuss the business case for sustainability and its measurement explicitly within an ecological stance (Willard, 2002; Willard, 2005; Willard, 2007; Willard, 2010b; Willard, 2012) [100].

"compatible" ecological macro-social and ecological macro-economic scholarship. As a result these authors argue that the majority of organization and management literature on sustainability must be considered carefully for its ability to misinform managers. Such advice, formed on a neo-classical base has the potential to contribute to rather than resolving the Global Problématique. A worrying situation given the practical and moral urgency established (1.3).

[100] Most researchers looking at issues of a business case for sustainability and its measurement are either proactively neo-classical or remain mute on the contextual assumptions they are making in their research, e.g. (Figge, Hahn, Schaltegger, & Wagner, 2002; M. E. Porter & Kramer, 2006)

- The work of a few management scholars and practitioners who discuss business models for firms who wish to create sustainable outcomes (Birkin, 2000; Birkin, Cashman, Koh, & Liu, 2009; Birkin, Polesie, & Lewis, 2009; Friend, 2005; Griffiths & Petrick, 2001; Stubbs & Cocklin, 2008; Willard, 2010a)[101].

- The work of management researchers focused on service systems design exploring what sustainability means in the service systems context (Cavagnaro & Curiel, 2006b; Cavagnaro, 2007; Cavagnaro & Raghoebarsing, 2008; Cavagnaro & Curiel, 2012; Ing, 2008; Ing, 2011)[102].

- The work of Gharajedaghi, one of Ackoff's PhD students suggested an extension to Ackoff's idea that organizations are ideal-seeking purposeful systems. Gharajedaghi suggested that organizations should be considered as multi-minded ideal-seeking purposeful systems, i.e. organizations are socially constructed by all the (self-selected) stakeholders of the organization (the multiple minds who see value in the organizations purposes and processes) based on their collective ideal desired value the organization should produce (Gharajedaghi, 2011, pp.10-13).

- The work of Allen, Boulton, et. al. provide advice to managers concerning the design of business process and strategy by ensuring understanding the biophysical, social and economic context for their organizations through the lens of complexity(P. M. Allen, Boulton, Strathern, & Baldwin, 2005).

[101] As with researchers on sustainability business cases most business model researchers are proactively neo-classical or remain mute on the contextual assumptions they are making in their research, e.g. the works reviewed by Zott et. al. (Zott, Amit, & Massa, 2011a; Zott, Amit, & Massa, 2011b).
[102] Much of this work takes a business model approach, albiet focused on service systems business models in the context of firms.

- The work of Ulrich on the application of systems thinking in any field, provides advice usable by managers and researches, related to the limitations of human comprehension. He suggests that a critical application of systems thinking is required in order for managers to avoid hubris and over-confidence, and take a humble perspective in their decision making (Ulrich, 1993)[103].
- The business novel by Langenwalter provides a engaging story for managers of one small U.S. mid-west based manufacturing organization's journey from conventional profit-first to a stance which was proactively attempting to achieve sustainability outcomes (Langenwalter, 2007).
- The work on the role of innovation in solving the Global Problématique at both the organizational and societal levels (Homer-Dixon, 2001).
- The work of Porter and Córdoba provide advice to management educators on how to apply systems approaches to understanding organizations to existing business and management school curricula (and hence provide indirect advice to mangers) (T. Porter & Córdoba, 2009).
- Additionally, within specific industries or professions there are also works relevant to ecological organizational sustainability researchers, e.g.
    - The work of product design scholars and practitioners, who provide advice to managers on product (and mostly by implication organization and service) design to achieving sustainable business outcomes within the holonic contexts (Shedroff & Lovins, 2009).

[103] This advice was acted upon in the selection for this research design of the philosophical bias of critical pragmatism (3.2.3.2)

- As an example from one sector, the work of scholars and practitioners in the food industry in which they explore how to create food for the increasing number of humanity while ensuring this can be done sustainably (MacRae, 1991; MacRae & Toronto Food Policy Council, 1999; Pollan, 2006).

Concluding on the paucity of useful scholarship for systems oriented micro-sociologists and micro-economists (i.e. management and organizational scholars in general, not just those focused on sustainability): In 1997 noted socio-technical systems scholar Emery (introduced in 3.5.2.2) wrote a postscript following the re-printing of his 1967 article that presaged the development of the "active social sciences": "The Next Thirty Years: Concepts, Methods and Anticipations".

With the benefit of 30 years of hindsight, in the postscript Emery provides a highly critical commentary on the majority in his field of micro-sociology (and by implication micro-economics):

"The majority view in social science then [1967] favoured 'the more scientific' [i.e. analytic] passive concept of its subject matter. Today after thirty years have lapsed, social science still holds with this passive view, and still stagnates" (Emery, 1997, p.932).

Interpreting this situation, it would appear a Khunian paradigm shift is required, and given the practical and moral importance (1.3), this need is urgent. The ecological macro- and micro-sociological and economic works cited above, do attempt to incite such a paradigm shift. However, these remain a very small fraction of the sociological and economic cannon, where the majority continue to take the neo-classical paradigm as legitimate for their normal science work.

Key Theoretical Frames for Organizational Strong Sustainability Research: Neo-Classical Conceptions of Organizations and Their Parts

In this research design a simple rejection of all neo-classical management, organizational and organizational sustainability research, despite sitting on these potentially rotten laurels, is not academically legitimate.

First of course there are the many neo-classical organization and management works within the key theoretical frames that support the profit-first world view (i.e. K0-PF).

However, even for the strong-sustainability world-view there may be works that do not explicitly take an ecological view, but which may still be of use. However, in selecting and applying these works within this research great care must be taken to ensure that, despite their neo-classical assumptions, the theories espoused are "compatible" with the existing formal, natural, ecological- macro-social and macro-economic science knowledge, i.e. that works selected are compatible with conceptions of organizational strong sustainability.

Works that appear to pass this test, and hence are useful to ecological organizational sustainability researchers, but which are clearly embedded in the neo-classical micro-social paradigm include:

- Porter and some other management and organizational Strategy and Innovation "gurus" in their (incomplete) journey towards an ecological stance (Christensen, Baumann, Ruggles, & Sadtler, 2006; Hart, 1995; Hart & Milstein, 2003; Lubin & Esty, 2010; Nidumolu, Prahalad, & Rangaswami, 2009; M. E. Porter, 1991; M. E. Porter & Kramer, 2006; M. E. Porter, 2010; M. E. Porter & Kramer, 2011).

- Osterwalder and other Strategy, Innovation and Management Information Systems business model researchers (introduced earlier), since there is nothing in this work which appears to be explicitly incompatible with ecological thought (Bouwman, 2002; de Reuver, Bouwman, & MacInnes, 2009; Günzel & Wilker, 2009; Lai, Weill, & Malone, 2006; Malone et al., 1999; Malone et al., 2006; Osterwalder, 2004a; Osterwalder & Pigneur, 2009; Osterwalder, 2010, 2011; Osterwalder & Smith, 2012; Solaimani & Bouwman, 2012; Zott, Amit, & Massa, 2011a; Zott, Amit, & Massa, 2011b).
- The work of Gharajedaghi related to multi-minded ideal seeking purposeful systems introduced above (Gharajedaghi, 2011, pp.10-13) can been seen as providing solid theoretical framework to a number of neo-classical management and organizational sustainability researchers who focus on organizations and their stakeholders. For example Gharajedaghi's framework provides a systems oriented theoretical underpinning to:
    - Hart and Sharma advise managers wishing to increase the resilience of their organizations to engage proactively with stakeholders who had here-to-for been excluded from power relationships with the organization. Hart and Sharma refer, from the organizational manager's perspective, to such previously disenfranchised stakeholder as "fringe stakeholders" (2004).
    - Conroy's review of how such fringe stakeholders have damaged and can plan to damage economic valuations of organizations in order to gain a power relationship with organizations to their advantage (Conroy, 2007).
    - The broad body of mostly neo-classical research on stakeholder relationships (Assadourian, 2005a; Assadourian, 2005b; A. L. Friedman, 2006; Hillman & Keim, 2001; Tapscott, 2006; Tapscott & Williams, 2012).
- Pagell and others focused in the Operations Management field on supply chains and sustainability (Kumar & Putnam, 2008; Pagell, Wu, & Murthy, 2007; Pagell & Wu, 2009; Pagell, Wu, & Wasserman, 2010; Seuring & Müller, 2008).

- Mellville recently called for the Management Information Systems field to focus on research related to sustainability and provided a sense of urgency and a manifesto for doing so, along with suggestions for such a research agenda. (Melville, 2010)[104].

3.5.3.3 Concluding on Key Theoretical Frames for Organizational Strong Sustainability

Despite the apparently significant number of works citied above, the systems perspectives on the natural and social science disciplines are comparatively undeveloped compared to the traditional neo-classical (analytic) approaches.

Given the context of the profound shift from machine age to systems age hypothesized by Ackoff (1974), this is entirely understandable given the relative youth of formal science systems approaches, let alone their natural and social science application.

Despite the relative youth of the systems approaches to natural, social, economic, psycho and physio-social science research, for organizational strong sustainability researchers the nature of the problem of organizational strong sustainability is made more tractable using systems oriented knowledge to build an understanding of the context of organizations (Ackoff, 1974; Kay et al., 1999; T. Porter & Córdoba, 2009).

Knowledge built using systems approaches aligns well to the earlier observation: strongly sustainability outcomes can only emerge from the organization understood as a holon, not an organization as an independent entity sans-context and contained systems (Marcus et al., 2010).

3.5.3.4 Applying Research on Systems and Organizational Strong Sustainability

The above completes the search of the literature related challenge 2-1: "How to understand the organizational sustainability problem and solution domain given organizations' and their contexts have a holonic relationship and that sustainability is an emergent property of this

[104] This call appears to getting some traction since as of October 10, 2012 it has 153 citations as per Google Scholar. As one more citation, this thesis, in its Management Information Systems stance, is acting upon a number of the elements in this agenda (including in the choices of the design science approach), and certainly aligns with the stated urgency (see Chapter 11).

system of systems" as subsequently clarified into a synthetic search and an analytic search of the literature (3.5.3).

Reflecting overall, given the objective of this research, all of the above works are considered to be additions to one or all of the K0, K0-PF and K0-SS key theoretical frames for this research. Having been introduced here, they are the subject of a systematic review in light of the research objectives in order to derive principles for the design of the business model ontology artefact (Chapter 4).

To guide a more detailed reflection on this literature and to apply the results to this research design a new question is:

> How to best apply (operationalize) the knowledge on organization strong sustainability given the research objective?

Based on the synthetic and analytic literature search above this question is answered under this heading resulting in the third pass of the overall research design (summarized in Figure 3-14 below) building on the second pass (3.5.1.5).

A Systemic Stance

This research applies descriptive science knowledge about organizations and their contexts that are premised on a systems view of organizational strong sustainability to increase the rigour of this design science research (captured in one or all of K0, K0-PF and K0-SS).

In turn this increases the legitimacy of the research outputs due to the alignment of the systems view of organizations and the desired normative outcome of the use of the designed artefact: helping managers to understand and then attempt to create conditions for strong sustainability outcomes to emerge.

A Definition of the Profit-First Organization

Restating the earlier definition (2.1):

A “profit-first” organization is one in which monetary profit is the sole legitimate objective; success is defined in terms of attempting to maximizing monetary profit at all times and over time

The world-view of persons who define organizational success in these terms agrees with the statement that:

There is one and only one social responsibility of business – to use its resources and engage in activities designed to increase profits so long as it stays within the rules of the game, which is to say, engages in open and free competition without deception or fraud. (M. Friedman, 1962, p.133)

Weak Sustainability

In this research the weak sustainability paradigm is taken to be desirable or possible by some managers (weak sustainability includes the possibility of being identical for all practical purposes with profit-first). This requires the inclusion of knowledge that defines and describes weak sustainability in the key theoretical frames. As noted earlier this component of the key theoretical frames is labelled K0-PF.

A Definition of Organizational Strong Sustainability

Restating the comment above (3.5.3.2) in order to develop a definition of organizational strong sustainability (K0-SS) it is necessary to take an ecological micro-sociological and ecological micro-economic stance.

Based on all the review of the literature presented, a useful working definition of organizational strong sustainability might be derived from Ehrenfeld[105]:

> A "[strongly] sustainable" organization is one in which all of its behaviours and all the behaviours of all other relevant social, economic and biophysical actors, lead to the possibility that human and other life will flourish on the planet forever.

The world-view of persons who define organizational success in these terms agrees that creating this possibility requires the integration of economic, social and biophysical objectives.

This definition concurs with Allen et. al. that "any definition of sustainability needs to answer of what, for whom, for how long and at what cost" and that sustainability is the process that "maintains or fosters the system contexts that produce the goods, services and amenities that people need or value at an acceptable [monetarily, social and/or natural environmental] cost" (T. F. H. Allen, 2003, p.26).

This definition of organizational strong sustainability would appear to hold irrespective of the socio-economic system in which an organization exists, i.e. it seems highly likely that humans will still form organizations to achieve objectives which individual humans cannot achieve (Ouchi, 1980).

The existing global socio-economic system[106] operates within a broad set of parameters[107]. Within this it appears significant progress can be made in achieving organizations to which this definition of organizational strongly sustainability can be

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[105] The term paper "Towards A Definition of Organizational [Strong] Sustainability"(Upward, 2010d) first espoused this definition.

[106] i.e. a modified for of capitalism operating in a range of political systems with some (limited) oversight from global institutions (UN, WTO, World Bank, etc.)

[107] There can be significant variation in these parameters, which are broadly described by the neo-classical macro-sociology approach of "ecological modernization" (Hannigan, 2006a, pp.25-28). For examples of possible significant changes based on ecological macro-economic thinking, but which that still largely remain within the existing socio-economic systems see Lawn, Jackson et. al., Sorrel and Victor (T. Jackson, Daly, Speth, & Korten, 2011; Lawn, 2010; Sorrell, 2010; Victor, 2008, ch.11).

fairly applied (i.e. attempts at operationalization of this definition based on current knowledge is possible) (e.g. B Lab, 2009).

These statements are explored in depth in Chapter 4.

Strong Sustainability

In this research the strong sustainability paradigm is taken to be desirable by some managers. This requires the explicit inclusion of knowledge that defines and describes strong sustainability in the key theoretical frames. As noted earlier this component of the key theoretical frames is labelled K0-SS.

Additional Key Theoretical Frames

Since the central topic of the ontology (the problem and solution domains) is aspects of organizations/firms important for strong sustainability outcomes to emerge, and in light of the knowledge reviewed above, the key theoretical frames related to this research need to be revisited (K0).

So far K0 has included the following fields of what can now be labelled neo-classical organization and management knowledge:

– Innovation

– Strategy

– Operations Management (OM)

– Management Information Systems (MIS)

Much of this knowledge is not compatible with the latest natural science, and ecological macro-sociological and ecological macro-economic knowledge and this forms the bulk of K0-PF. However, some of this knowledge is found to be compatible, or at least not explicitly contrary to strong sustainability. Hence, some portion of this knowledge may be generally relevant (captured in K0), or relevant specifically to the organizational strong sustainability world view (captured in K0-SS).

Based on the above literature review, the list of key theoretical frames can be amended to include knowledge that follows the ecological / systems stance (forming the bulk of K0-SS), i.e.:

1. Formal science – information systems (computation), systems, complexity and chaos (i.e. theorization which supports the processes of analysis and synthesis required to design the research, build and evaluate the ontology artefact and subsequently use it in practice).
2. Natural science – Physics, Chemistry, Biology, Ecology (i.e. evidence on what constitutes strong sustainability from a biophysical perspective).
3. (Environmental) Social science (i.e. evidence on what constitutes strong sustainability from a social perspective).
4. (Ecological) Economics (i.e. evidence on what constitutes strong sustainable from a economic (financial / monetary) perspective.

To be useful and valid the ontology synthesizes knowledge from all these key theoretical frames, K0, including K0-PF, and K0-SS (Figure 3-11).

Research Artefact

Applying the above search of literature and reflection, the artefacts produced by this research can now[108] be given the name which appears in the title of this thesis.

The Strongly Sustainable Business Model Ontology (SSBMO).

The Strongly Sustainable Business Model Canvas (SSBMC) conceptually ‘powered by’ the SSBMO.

[108] Finally.

Further, based on the two overall ontology design principles (OPD1 & 2), to maximize utility of these artefacts irrespective of the world-view of their users, requires that the:

The SSBMC and the SSBMO it powers must be able to describe strongly sustainable ***or*** profit-first business models.

Scope of Problem / Solution Domains

The problem / solution domain for this research can now be expressed as two more detailed research questions:

RQa: How can strong sustainability emerge as an outcome of an organization understood as a multi-minded ideal-seeking purposeful system (analysis), and what systems contain / provide context for an organization so understood (synthesis)?

RQb: How can such an understanding be modelled using an ontology in order to enable a tool useful for managers attempting to design the conditions from which strongly sustainable outcomes may emerge from and for their organizations?

Scope / Boundary of the Strongly Sustainable Business Model Ontology

Reflecting on the literature, and applying it to the question of what explicitly needs to be conceptualized in the SSBMO, leads to the first statement of the required conceptual scope or boundary of the artefact to be designed:

- The systems that contain a firm.
- The systems that comprise the parts of a firm.
- The systems that as a whole need to be sustained and might be positively or negatively impacted based on a firm's behaviours.

Specifically this means the ontology must conceptualize the nested systems of the bio-physical environment of planet earth, the human constructed social systems, and the human constructed financial / monetary systems and their individual and collective relationships with a firm.

Concluding on the question introduced above (3.5.3.4): "How to best apply (operationalize) the knowledge on organization strong sustainability given the research objective?" Based on the reflection presented, this question was answered. This results in the third pass of the overall research design (summarized in Figure 3-14 below), built on the second pass introduced earlier (Figure 3-12).

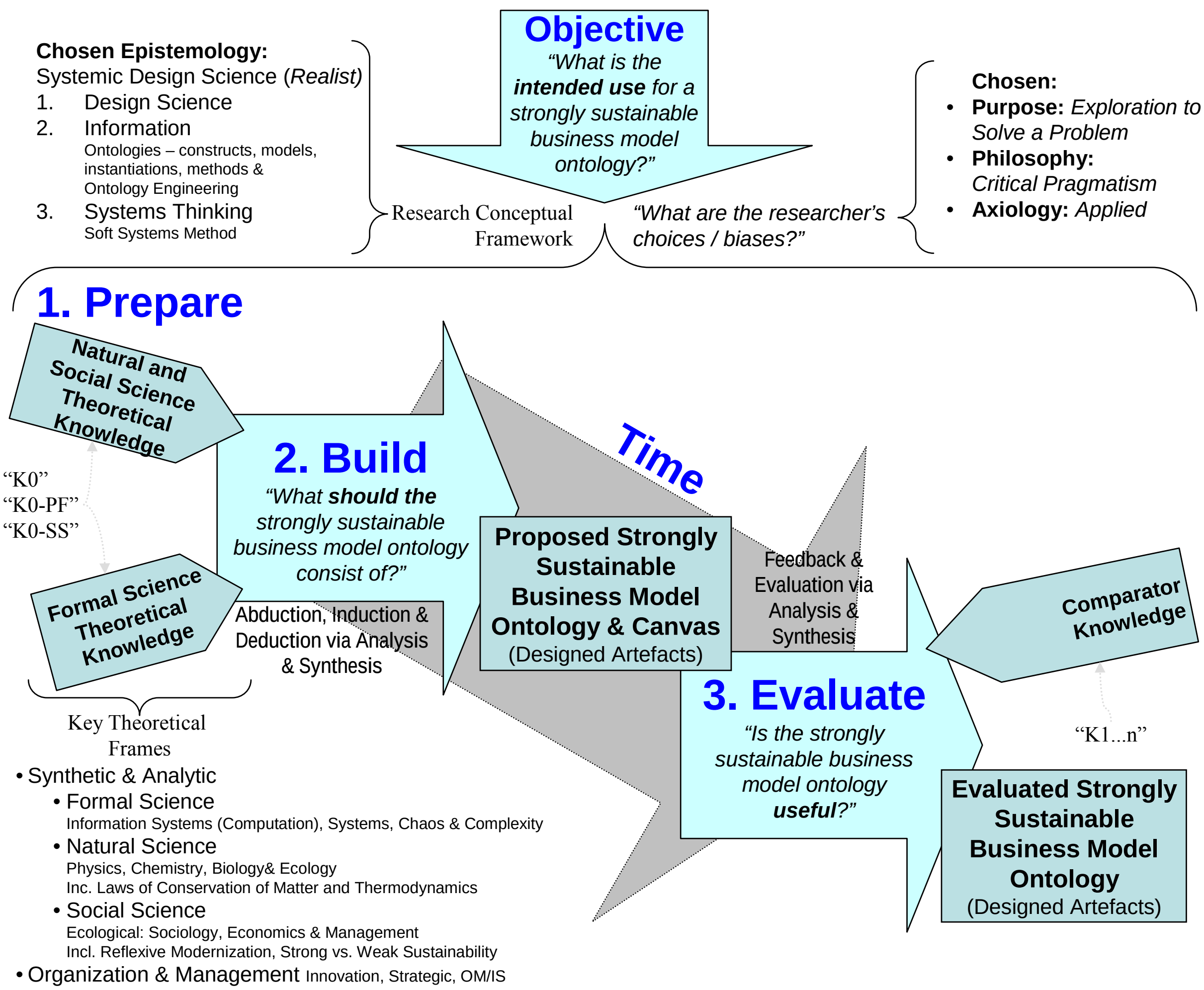


Figure 3-14: Overall Research Design – Third Pass

Compared to the second pass (Figure 3-12) this summary reflects the choices that add and / or refine the following aspects of the overall research design:

- Updating the questions related to the definition of the:
  - Research objective
  - The activity streams build and evaluate.
- Updating the label given to the artefacts to be built and evaluated – reflecting the title of this research.
- Adding label for the overall epistemological approach "systemic design science" – reflecting the title of this research. This requires adding the epistemology from the formal science of systems, specifically soft systems methodology and the connection between systems and design epistemologies. The selected approach includes the appropriate use of both synthetic and analytic techniques, complementing the techniques of abduction, induction and deduction introduced in the 1st pass.
- Adding all the remaining key theoretical frames based on a review of the literature (listed above and summarized on the diagram)

3.5.3.5 Meeting the Research Objective and Testing the Working Hypotheses

Recalling the overall objective for this research (2.2) and the working hypotheses (2.4): the rationale for choosing, and the choice of the systemic key theoretical frames for the strongly sustainable business model ontology adds to the evidence already presented suggesting that the research question can be answered in the affirmative and that working hypotheses are confirmed.

3.5.4 Challenge 2-2: Systemic Design Science Methodology

Based on the identified gap in the literature (3.5.2.4) an acceptable response to Challenge Two, ensuring rigour, required the integration of the systems and design understandings of organizational sustainability **and** the related epistemological processes: i.e. the creation of a systemic design science approach for this research.

To take a systemic design science approach to researching organizational strong sustainability implies that that:

- The artefact being built must be able to include appropriate representations of the systems from which strong sustainability may emerge as an outcome (see Challenge 1 and Challenge 2-1 above) **and**
- The research methodology must explicitly deal with how to create and evaluate the design artefact systemically.

3.5.4.1 Systemic Design for Organizational Strong Sustainability Artefacts

Challenge 2-2 reflects this latter concern: "How to undertake the creation of organizational sustainability artefacts given such problems can be solved more effectively if a systemic approach is used (Prepare, Build and Evaluate)", i.e. How to undertake the activity streams to create and evaluate artefacts related to organizational strong sustainability in the most rigorous manner possible?

While the literature reviewed has shown that the integration of systems thinking and design science research has started, at this time applications of these approaches to organizational strong sustainability problems have not been found.

To start to fill this gap in the literature, in this sub-section research design elements believed required to systemically (and hence rigorously) undertake the activity streams and create the organizational strong sustainability design science research artefacts are developed. The now familiar search, reflect and apply three step process is used to develop these research design elements for aspects of each of the activity streams.

The next headings (3.5.4.2-3.5.4.7) search the relevant systems and design literature for advice on how to maximize the rigor in each of these activity streams from multiple aspects. The following headings (3.5.4.8-3.5.4.9) reflect on and apply the results of the search leading to a response to challenge 2-2 and the fourth and final pass of the research design.

3.5.4.2 Systemic Preparation: Objective Setting

A common criterion for research output legitimacy is the degree to which the researcher explicitly identifies and attempts to minimize bias. In design science this problem is particularly acute since a single researcher or research team will be setting the (normative) goals for the design, designing an artefact (possibly with others in an action research mode) and then evaluating the utility of the artefact (again possibly with others in an action research mode).

Hence during preparation stage it becomes critical to take actions to minimize subsequent bias by explicitly setting out the objectives of the research (Al-debei, 2010). This gives a base from which, in particular, the subsequent evaluation work can be conducted, increasing the likelihood that the broadest range of feedback on artefact utility can be gathered.

The explicit setting of objectives is, of course, common to descriptive and design science research. However, the systems literature, with its explicit focus on wholes and parts, requires special attention be paid to context; in this case the context (goals) of the artefact (Ledington & Ledington, 1999).

Summarizing the suggestions from Ledington and Al-Debei, during the preparation stage systemic design science researchers should:

1. State research purpose / question including cultural background and assumptions.
2. Describe the expected user of the artefact including cultural background and assumptions.
3. State design principles based on an understand of the problem space, identifying the applicable descriptive science knowledge and normative goals of the research.
4. State exclusions / limitations.
5. Surface designer and user context for the build and evaluate activities (i.e. expectations desirability, importance).
6. Develop specifications of the desired utility (completeness, quality, beauty) of the artefact which is intended to contribute to the solution of the research problem.

Surfacing Designer and User Context

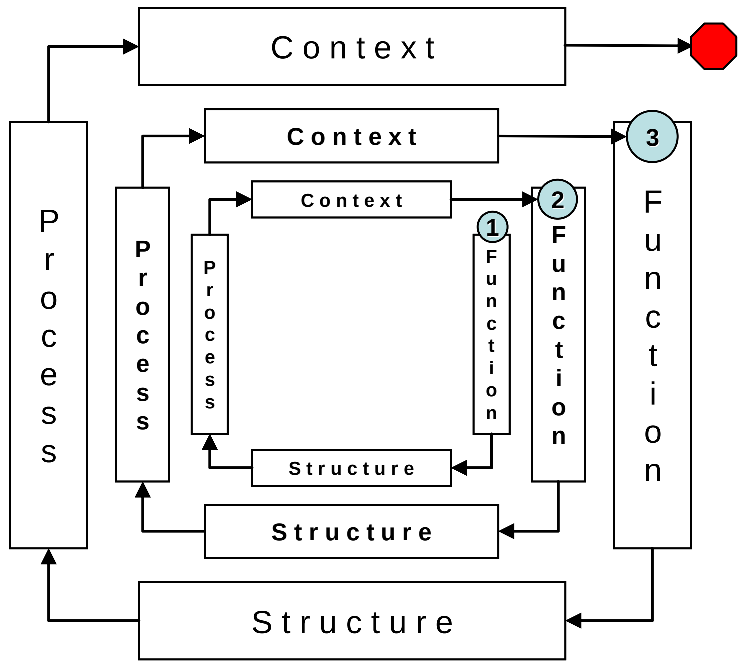
Related to item 5 above, Ledington and Ledington observed that it is natural for designers to (need to) have high expectations that the artefact they are building will be highly desirable and highly important to solving the problem at hand. Similarly, it is natural for users to (want to) have high expectations that the artefact that is being built will be highly desirable and highly important to solving their problem. This mental frame of reference is (implicitly) shared / co-created by both the designers and users. It acts as a context (a bias) to all subsequent activities. Thus, these authors suggest, it is critical to undertake activities early to surface this context to help the designers to consider alternatives and the users to specify their evaluation criteria. They provide specific advice on how to accomplish this (Ledington & Ledington, 1999, p.336).

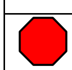
For detailed review of this technique see 6.2.7.4 (Table 6-13) and 6.4.4 for a presentation of a reflection and the application of this technique in the detailed evaluation research design.

3.5.4.3 Systemic Preparation and Build: Iteration

Building on the work of Ackoff, Churchman, and Singer, Gharajedaghi suggests that every purposeful system has structure, process and functions, and operates in a wider context (2011, pp.89-93). Hence it is necessary for

> *The design approach iteratively examins structure, function, and process to develop understanding in terms of design. Iteration is necessary because, in the systems approach, process and structure co-produce function in the context of environment. Inquiry then becomes necessarily iterative because structure, function, and process are each co-produced by the others, as well as co-producing each other, so that developing a new understanding of each modifies the understanding of the others in a converging sequence of mutual dependence* (Miettinen, 2008).



1	Start of an iteration of inquiry; After each iteration, pause and synthesize the information into a cohesive image (concept) of the whole system under study. After each iteration a pause is taken to synthesize the results
	Iteration is stopped once a sufficiently† detailed cohesive image or concept of the whole system under study and its context (environment) is known

† A number of authors, writing from the soft systems methodological (SSM) perspective, have suggested that the SSM CATWOE technique can be used as a useful test of sufficiency (Bergvall-Kåreborn, Mirijamdotter, & Basden, 2004; Smyth & Checkland, 1976; Wilson, 2001). The CATWOE technique involves examining the system under study from 6 perspectives: Client, Actors, Transformation, World-view, Owners and Environment. This test is claimed to be both necessary and sufficient to determine sufficiency.

Function	Why does it‡ exist (purpose / goals / outcomes / results)?
Structure	How is it organized (components, their inter-relationships)?
Process	What happens to it over time (sequence, know-how to produce outcome and meet goals)?
Context	What is its relationship to containing whole (its environment)?

‡ The system being studied – i.e. the problem in the scope of the research (during the preparation stage) or the artefact being built (during the build stage)

Figure 3-15: A Systemic Approach to Design Science Preparation and Build
(From Gharajedaghi, 2006, Fig.5.5; 2011, Fig.5.4)

Figure 3-15 illustrates Gharajedaghi and Miettinen's advice to researchers on how to undertake systematic inquiry (in the preparation activity stream) and systemic design (in the build activity stream) of systemic design science research. Through this approach the likelihood of a well formed understanding of the systems in the problem space and an artefact suitable to contributing to the resolution of those problems being developed is improved.

3.5.4.4 Systemic Preparation, Build and Evaluate: Setting Boundaries

Ulrich, in a work concerning the application of systems thinking in any field, provides advice usable by researchers related to the limitations of human comprehension. He suggests that the critical application of systems thinking is required (he calls this "critical holosim" in order for researchers to avoid hubris and over-confidence, and take a humble perspective in their decision making (Ulrich, 1993).

Building on the work of Churchman, Ulrich states that systems do not exist in the world with absolute boundaries; rather useful model(s) of the system(s) being studied are constructed by the researcher based on the nature of the problem and its designed solution. This inevitably means the view of the researcher of both the problem and its design solution is partial. By being as explicit as possible about the chosen facts and values that define the boundary of the systems under consideration the researcher is better able to make claims to the legitimacy of the system boundary (Ulrich, 1993; Ulrich, 2002; Ulrich, 2005).

For the systemic design science organizational strong sustainability researcher this suggests that to increase rigor it is important to explicitly define the boundary of the problem and designed artefact. The following, based on the contextual systems for organizational strong sustainability research identified earlier (3.5.3.1, 3.5.3.2), are a partial and initial list of aspects of boundaries that might be considered:

- ***Biosphere***. Material and energy flows into and out of the 'control' of the organization.
- ***Society***. Relationships that the organization has, such as the various types of stakeholders (e.g. employees, managers, shareholders, investors, suppliers, customers,

employees' families, communities, governments, non-governmental organizations, non-humans etc.), clearly identifying the nature of those relationships (e.g. selling, acquisition of resources, legal – 'personhood', 'ownership') and relevant information (e.g. stakeholder needs, organizational value propositions, etc.).

- ***Economy***. Types of monetary flows into and out of the organization (e.g. investment, revenue, payments, interest, dividends, etc.).

3.5.4.5 Systemic Preparation, Build and Evaluate: Identifying World-Views

As discussed earlier, any design activity will involve normative aspects: design is about making choices (3.4.6.1). Hence the researcher's world-view (values and value-system) will inevitably inform those choices.

Building on Ulrich's ideas discussed above, rigour and hence legitimacy can be better assured by researchers being as explicit as possible about each and every choice and associated world-view element. This provides maximum possible transparency in the design process, i.e. the researcher will provide traceability of design choices back to both the descriptive science evidence **and** the world-view that led each choice to be deemed valid in the context of the research problem domain.

Many (most) design choices will be supported by descriptive science evidence. However, it is also a reality that some of the choices will be legitimately under-pinned by personal conceptions of beauty, or moral conceptions of "rightness". In turn these conceptions will be based on belief that these conceptions will lead to the desired improvement; for these beliefs there is perhaps no scientifically valid knowledge. Again the literatures suggest any such choices and their supporting world-views should be made explicit.

Summarizing, to achieve maximum rigor, researchers should attempt to be as explicit as possible about:

1. Each choice made during preparation, build and evaluation, including reference to applicable antecedents in similar design science research.

2. The associated world-view and any assumptions behind the world view of each choice.

3. Descriptive science knowledge (theories and their justifications) which suggest or support the validity of each choice.

Surfacing the reasons for each design choice can be undertaken by deep reflection, comparing and contrasting the fields and disciplines of each piece of supporting knowledge, along with the particular world-views of each source.

Supporting these recommendations, citing March and Smith's 1995 work (pp.260-261), Osterwalder (2004, pp.127-129) suggests that the first level of evaluation of artefact utility (and hence legitimacy) is the strength of the researchers argument highlighting the similarities to and differences from previous work, i.e. the choice of which descriptive science knowledge is relevant.

But there is an additional perspective on world-views of which researchers need to be concerned. Users of artefacts produced by design science research are often expected to include persons other than the researcher, in the case of this research, managers of organizations. It is intended that these persons will find the designed artefact useful in resolving a problem. Hence, it is also important to consider how the world-views of the potential users might impact the utility of the artefact.

For example, based on the earlier discussion, generically, as a design science research artefact, an ontology can aid in communicating its encapsulated concepts and their relationships to users. However, for a specific ontology to realize this potential requires the systemic design science researcher to carefully consider how the choices they make about the design of the ontology, based on their world-view, might be in conflict with the world-view of their intended users. Such conflicts in world-view could reduce the potential for useful communication of the encapsulated concepts and their relationships to the users and hence impact the utility of the artefact. This is a particular concern with organizational strong sustainability artefacts given, as discussed earlier (3.4.6.1), these must include both facts and the designer's values.

Soft systems methodology provides some specific techniques for attempting to make explicit such differing assumptions about problems and their solutions based on differing world-views of users and researchers. For example Mason and Mitroff suggest a technique, which again builds on the work of Churchman, known as Strategic Assumption Surfacing and Testing (SAST) (Mason, 1981). SAST has a four step approach which systemic design science researchers can use to "surface differing assumptions, beliefs and world-views involved in problem situation" (M. C. Jackson, 2000, p.226).

3.5.4.6 Systemic Evaluation: Triangulation Diversity

Triangulation is a well known and key technique for ensuring the rigor in the research process and the legitimacy of the research process (Yin, 2009, pp.114-118).

A sample of the literature on evaluation in design science research suggests that evaluation can be defined as the process of determining the worth, merit, significance and opportunities for the improvement of artefacts through the objective and systematic collection of information. Evaluations are the outcomes of that process (Cleven et al., 2009; Hevner & Chatterjee, 2010b, pp.109-111).

From this definition of evaluation, maximizing the rigour in the evaluation stage of systemic design science research requires a diversity of triangulation:

- ***Approaches***, i.e. various evaluative techniques – such as static analysis, simulation, interviews, focus groups, observation and case study, and
- ***Comparator Knowledge Sources***, i.e. various sources of knowledge about the utility (completeness, quality and beauty) of the artefact – such as academic research, practitioner documentation, and individuals' tacit or explicit knowledge, based on a variety of world-views.

The range of possible techniques to undertake triangulated approaches to evaluation are well known and used in many different research epistemologies. However, the issue of ensuring diversity in comparator knowledge sources is perhaps more specific to design science. The rest of this section presents advice on this topic via a synthesis of the systems and design science literature.

Firstly: a key criterion for selecting comparator knowledge sources is that they not be included or used to justify the artefact itself. Comparing a knowledge source used to build or used to justify the designed artefact to the resulting artefact is unlikely to yield useful evaluations of artefact utility!

Secondly: as established earlier (3.4.7.1), in design science research it is generally recognized that the artefacts produced by design science research consist of constructs, their inter-relationships (models), and instantiations of those models (March & Smith, 1995, p.255).

Hence, when selecting comparator knowledge sources researchers should consider whether utility may be best evaluated using different types of knowledge for each of the constructs, models and instantiations. For example only comparing constructs and models to a small number of example instantiations may not yield useful evaluations of the completeness of the artefact. Vice versa only comparing instantiations to generalized sources of knowledge about the problem may not yield useful evaluations of the quality of the artefact.

Coming from the soft systems perspective, Baskerville et. al., in their work to integrate design science and soft systems methodologies, identify similar concerns (2009). In their proposed soft systems design methodology (SDM, see Figure 3-13) it is clear that the knowledge sources used in the comparison of the developed understanding of the problem domain with the general requirements for a solution (step 5 of SDM) will be different from the knowledge sources used in the later evaluation of the specific problem being solved and the designed solution (between step 7 and 1 of SDM). The former evaluation has similar characteristics to the design science evaluation of constructs and models, where as the latter is similar to the evaluation of instantiations.

Thirdly: Any conceptual artefact is just a model, and not reality. Hence when comparing knowledge to the artefact it is important to recognize that the artefact does not exist in the reality it is intended to describe. As Ledington and Ledington state: since a "conceptual model is built entirely from a root definition and structured according to logic […] why should some version of this model exist in reality? Indeed what is the mechanism by which such a model causes a version of itself to exist?" (1999, p.333).

These authors suggest that as a result the appropriate direction of comparison is to ask "to what extent is there a likeness between the model and the situation; that is to what extent can the situation be conceptualized in terms of the elements expressed in the conceptual model" and not the other way around which would assume the model exists in the world (p. 333).

Fourthly: As discussed earlier, differing world-views of the designer and users may significantly impact utility. Hence, when selecting comparator knowledge sources researchers should attempt to include knowledge sources derived from similar and different world-views to the designers, reflecting the range of world-views of each artefact's potential users.

In the example where the artefact is an ontology, such a diversity of world-views underpinning comparator knowledge sources will help evaluate whether differences between the designer's and users' world-views impedes the communication of the knowledge embedded in the ontology, and hence reduces its utility.

Fifthly: Returning to the earlier discussion of surfacing and removing sources of bias, during evaluation researchers should make use, as a comparator knowledge source, the documented objectives, including the expectation, desirability and importance frameworks suggested by Ledington to support the "interpretation of the [evaluation] results" (Ledington & Ledington, 1999).

3.5.4.7 Summary of Systemic Design

Table 3-10 summarizes all the suggestions made to respond to Challenge 2-2: "How to undertake the creation of organizational sustainability artefacts given such problems can be solved more effectively if a systemic approach is used (Prepare, Build and Evaluate)" (3.5.2.4)?

Techniques \ Design Science Research Stage	Prepare	Build	Evaluate
1. Objective Setting	✓		
2. Iteration	✓	✓	
3. Setting Boundaries	✓	✓	✓
4. Identifying World-views	✓	✓	✓
5. Diversity of Triangulation Approaches and Comparator Knowledge Sources			✓

Table 3-10: Comparison of Design Science Research Stages and Techniques to Improve the Rigour of Systemic Design Science Research

3.5.4.8 Applying Research on Systemic Design Methodology

The above complete the search of the literature related to Challenge 2-2 (3.5.2.4).

To guide a detailed reflection on this literature and to apply the results to this research design a new question is:

> How to best apply (operationalize) the knowledge on ensuring rigour in systemic design science research prepare, build and evaluate activity streams given the research objective?

Based on the literature search above this question is answered under this heading resulting in the fourth pass of the overall research design (summarized in Figure 3-16 below) building on the third pass (3.5.3.4).

Systemic Preparation: Objective Setting

The advice on setting objectives has already been applied multiple times in the development of the overall research design (e.g. 2.2 Research Question and Goal, and many sections of this chapter).

Systemic Preparation and Build: Iteration

The advice on iteration has already applied multiple times in the development of the overall research design, e.g. the overall steps of search, reflect and apply introduced at the start of this part (Figure II-1 & Figure II-2).

This advice is now applied to the steps to be undertaken in each research activity stream – prepare, build and evaluate based on Gharajedaghi's four perspectives (3.5.4.3) and between the build and evaluate activity stream based on Hevner's advice (3.4.7.2).

Systemic Preparation, Build and Evaluate: Setting Boundaries

The advice on setting boundaries has already been applied multiple times in the development of the overall research design (e.g. 1.: Context and Motivation, 2.6 Design Limitations, and many sections of this chapter)

Given the introduction of the key theoretical frames it is now possible to set the parameters for the overall boundary for the strongly sustainable business model ontology.

- ***The social definition of a firm's boundary***. Gharajedaghi suggests the social boundary of the firm is based on the agreement of the firm's purposes which is made by all the multiple minds involved in the firm. The agreed purpose is based on the sub-set of the minds' needs that the firm will meet. These minds include: employees, managers, shareholders, investors, suppliers, customers, employees' families, communities, governments, non-governmental organizations, non-humans etc.

- ***The legal definition of a firm's boundary***. i.e. the concept of 'ownership' and the concept of the firm as a 'legal person' (with the rights and obligations this entails) .

- ***The systems outside a firm's boundary***: i.e. system of systems of which a firm is a part (including other firms, networks of firms, communities, the human constructed social and monetary domains and the biophysical environment).
- ***The systems within a firm's boundary***: i.e. those aspects of the system of systems which comprises the firm that are relevant (i.e. the system of a firm's business processes).
- ***The conceptual (knowledge), social (relationships) and 'objective' (physical) artefacts inside*** a firm's boundary that need to be 'owned' or 'controlled' by the firm to fulfill the firms' agreed purposes (broadly the firms capabilities and resources).
- ***The social (relationships), physical and conceptual artefacts that are 'shared'*** with stakeholders via the containing systems, e.g. formal agreements with stakeholders, monetary flows with stakeholders (investments, revenues, payments, interest, dividends), bio-physical stocks and material flows to and from eco-system services, energy flows to and from the biosphere.

Systemic Preparation, Build and Evaluate: Identifying World-Views

The advice on explicitly identifying world views of the researcher and the potential users of the designed artefact has already been applied multiple times in the development of the overall research design.

This has culminated in the identification of the potentially conflicting world views in the key theoretical frames (K0-PF Profit First and K0-SS Strong Sustainability).

Systemic Evaluation: Triangulation Diversity

The advice on ensuring triangulation diversity in the evaluation activity stream is introduced here with the expansion of the previously introduced concept of multiple comparator sources of knowledge (K1…K6) (3.2.3.4).

The chosen comparator knowledge sources are:

– Explicit knowledge of business and sustainability (labelled K1, K2 and K3) based on the Soft Systems Methodology CATWOE technique (see Figure 3-15), the Benefit Corporation Impact Assessment Survey v3, and publically available knowledge about the Timberland Company.

– Tacit knowledge about firms, business models and business modelling (labelled K4 and K5) based on the experience and knowledge of seven experts with a range of world views.

– Explicit and tacit knowledge of specific firms and their business models (labelled K6) gathered via case studies from three firms with varying levels of strategic alignment and performance against a range of world-views.

Further detail and justification of these choices is provided in the detailed design of the evaluation activity stream (Chapter 6).

Concluding on the question introduced under this heading "How to best apply (operationalize) the knowledge on ensuring rigour in systemic design science research prepare, build and evaluate activity streams given the research objective" (3.5.4.8)?

This results in the fourth (final) pass of the overall research design (summarized in Figure 3-16), built on the third pass introduced earlier (Figure 3-14).

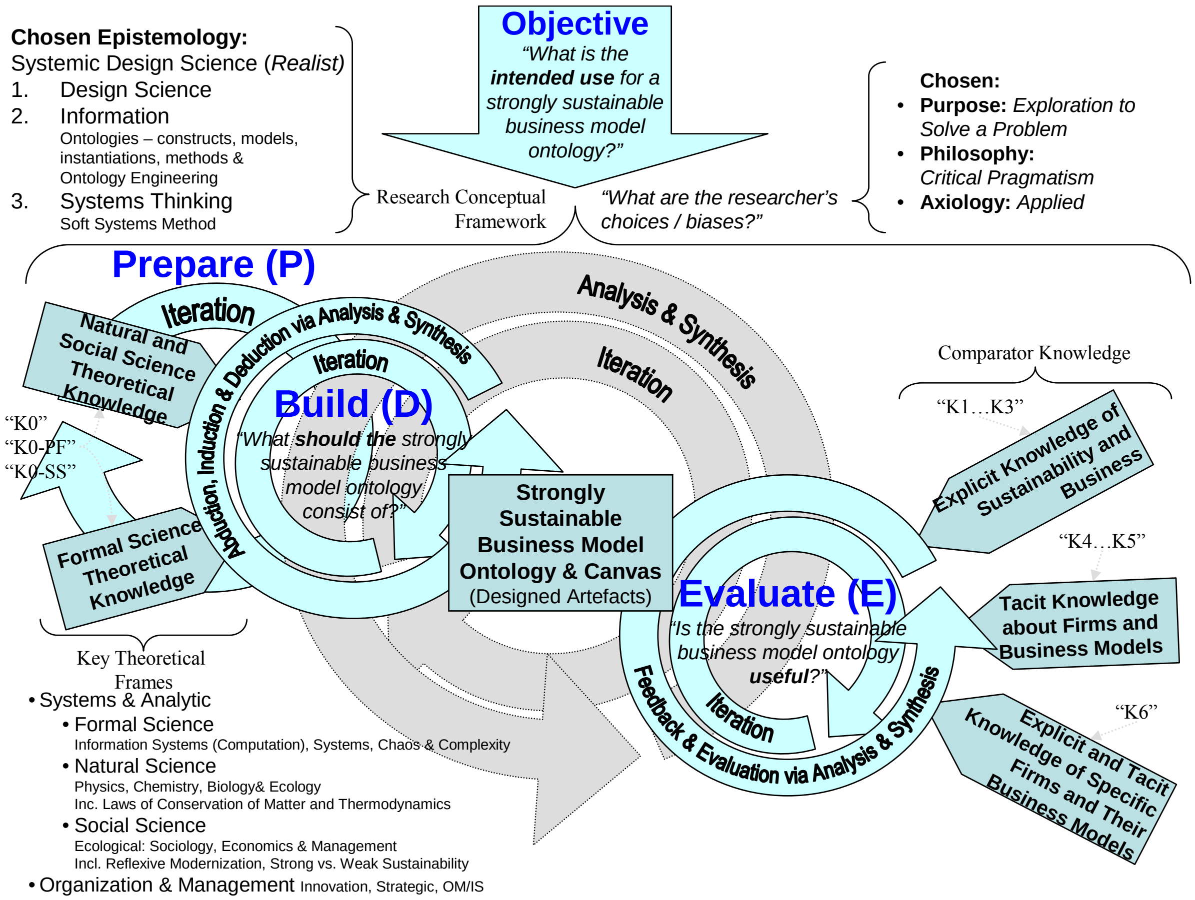


Figure 3-16: Research Design – Fourth Pass (Final)

Compared to the third pass this summary reflects the choices that add and / or refine the following aspects of the overall research design:

- Adding the iterative processes within each activity stream (prepare, build and evaluation) as well as the overall iteration between build and evaluate (which necessitates removing the graphical distinction between the proposed SSBMO and the evaluated SSBMO)

- Identifying the three distinct sources of comparator knowledge
  - Explicit knowledge of business and sustainability (labelled K1, K2 and K3)
  - Tacit knowledge about firms and business models (labelled K4 and K5)

– Explicit and tacit knowledge of specific firms and their business models (labelled K6).

3.5.4.9 Application of Recommendations for Rigour in Detailed Research Design

The application of the advice on achieving rigour to this systemic design science overall research design will be further elaborated in the detailed research designs for the prepare, build and evaluation activity streams (Chapters 4-6).

3.5.4.10 Meeting the Research Objective and Testing the Working Hypotheses

Recalling the overall objective for this research (2.2) and the working hypotheses (2.4): the rationale for choosing, and the choice of the methods and techniques to ensure rigor in the preparation, build and evaluation of the SSBMO and SSBMC, adds to the evidence already presented that the research question can be answered in the affirmative and that working hypotheses are confirmed.

3.5.5 Summary of Challenge Two

This section has identified, based on a review of the literature, a range of design science and systems research design elements that systemic design science researchers can use to increase the rigour of their research designs and hence the legitimacy of the output of their research.

After reflection this knowledge was applied to the overall research design given the objectives of this research: the rigorous production of a useful, and hence legitimate, SSBMO.

3.6 Review: Systemic Design Science Strongly Sustainable Organizational Research

3.6.1 Introduction

This chapter opened the second part of this thesis, having explored the context and motivation for this research (Chapter 1) and introduced the Research Goals and Approach (Chapter 2).

In this chapter the three step process, introduced at the start this part, was repeatedly used to systemically search for, reflect upon and to attempt to apply all the elements needed to create the most rigorous overall research design possible. The goal of this research design is to produce artefacts with the highest level of legitimacy given the objective of this research: the Strongly Sustainable Business Model Ontology (SSBMO) and Canvas (SSBMC).

The overall design of this research:

1. Critically
2. pragmatically and
3. systematically
4. designs (iteratively prepares for, then builds and evaluates)
5. an artefact, a domain ontology expressed in a semi-formal language
6. that can describe strongly sustainable business models (the SSBMO and SSBMC it conceptually powers)
7. using key theoretical frames based on a range of world views, from “profit-first” to “strongly sustainable” (K0, K0-PF, K0-SS), and a number of sources of comparator knowledge (K1…K6).

A question posed at the start of this chapter was:

> Are there alternative methods of knowledge production, complementary to descriptive science, which could increase the speed of generating legitimate knowledge that could be applied by managers to avoid worsening or to help resolve the Global Problématique?

Based on the overall research design developed in this chapter, the answer to this question is Yes! This section concludes the chapter by reviewing the final overall Systemic Design Science research design which supports this assertion.

3.6.2 Summary of the Process Used to Develop the Overall Research Design

To create the research design the literature was consulted to understand how this might be best accomplished. This review suggested that a conceptual framework is required for any research. This led to the development of a conceptual framework for this research (3.2Conceptual Framework):

- A critical pragmatic philosophical stance
- Key theoretical frames
- Comparator knowledge relevant to the research objective.

Within the established conceptual framework a question was then posed:

> What epistemological approaches will best meet the research objective?

A further review of the literature suggested that there is an urgent and largely unmet need of managers that requires researchers to improve the quantity of useful and utilizable knowledge about organizational strong sustainability. Further that this need was unlikely to be met using the typical descriptive science techniques (3.3).

This led to a clarifying question to guide the search of, reflection on and application of the literature to determine the best epistemological approach given the research objective:

> Are there alternative methods of knowledge production, complementary to descriptive science, which could increase the speed of generating legitimate knowledge that could be applied by managers to avoid worsening or to help resolve the Global Problématique?

A review of the literature suggested that organizational strong sustainability is an emergent property of human values and human organizations embedded in their ever-changing economic, social and biophysical contexts. This led to the identification of the design science epistemological approach as uniquely able to integrate facts and values that this understanding of organizational strong sustainability requires (0).

This led to a further question:

> How should a researcher best maximize rigour in design science organizational research?

To start to answer this question the literature on design science was consulted to construct a first pass of the overall research design including design science as the epistemological anchor for this research (3.4.9).

During this review of the literature two challenges with maximizing rigour in design science organizational research were identified given the objective of this research (3.5):

> **Challenge One:** How to determine what artefact this research will build – i.e. an artefact with high utility to managers looking to solve organizational sustainability problems?
>
> **Challenge Two:** How to ensure rigour in this organizational sustainability design science research and hence the legitimacy of its designed artefact?

To responding to Challenge One the literature on design science and ontology engineering was consulted. This identified that a business model ontology is an artefact with high utility to managers that could meet the objective of this research. This led to a second pass of the overall research design to reflect this (3.5.1.5).

Developing the first two passes of the overall research design identified from the literature a concern with the applicability of the design science epistemology to organizational ***sustainability*** research (3.5.2):

> Is the design science literature's advice on rigour in organizational research necessary **and** sufficient for organizational ***sustainability*** research?

This led to the introduction of a formal systems perspective on organizations and the identification of a gap in the literature related to advice on ensuring rigour given the objective of this research (3.5.2.2). This allowed a clarification of Challenge Two (3.5.2.4):

> **Challenge Two:** how to rigorsly undertake this organizational sustainability design science research by taking an ***appropriately systemic approach***, and hence ensure legitimacy of its designed artefact?

Exploring Challenge Two using systems thinking techniques led to further clarifications in order to make the development of a response more tractable:

> **Challenge 2-1**: How to best understand the organizational sustainability problem and solution domains given organizations' and their contexts have a holonic relationship and that sustainability is an emergent property of this system of systems (***Prepare***)
>
> **a.** How to best understand the context of organizations systemically (synthesis)?
>
> **b.** How to best understand the parts of organizations systemically (analysis)?

Challenge 2-2: How to best undertake the creation of organizational sustainability artefacts given such problems can be solved more effectively if a systemic approach is used (***Prepare, Build and Evaluate***)

To respond to Challenge 2-1 the literature suggested that all organizational strong sustainability researchers should attempt to explicitly leverage the latest natural, social and formal descriptive science knowledge which explicitly considers the applicable systems that form the contexts to all human organizations (labelled "ecological").

This led to the identification of additional key theoretical frames, including the concepts of weak and strong sustainability, and to construct a third pass of the overall research design to reflect these (3.5.3.4).

To respond to Challenge 2-2 a novel integration of design science and systems approaches was developed for this research: systemic design science. This included the identification of research design elements required to ensure rigour in organizational strong sustainability research: systemic approaches to setting objectives, the use of iteration, the need to set boundaries, the identification of world views and the need for triangulation diversity. Applying these design elements in light of the objective of this research enabled the construction of the fourth and final pass of the overall research design (3.5.4.8).

Possible Methodological Contributions

This process, found necessary to develop an appropriately rigorous overall research design, suggests a number of possible contributions to epistemological rigour. The resultant systemic design science overall research design is also a possible contribution. These possible contributions will be explored in Chapter 10.

However, it this point, it is worth noting that the research design developed for the creation of the SSBMO has many of the features of the "Third Generation" systems and design methodology proposed by Pourdnhad et. al (Pourdehnad, Wexler, & Wilson, 2011a; Pourdehnad, Wexler, & Wilson, 2011b).

3.6.3 Commentary on Artefact and Methodological Context

Figure 3-9: Problem Space of Exemplar Organizational Ontologies and Figure 3-10: Abstraction in Generic Ontology and Business Ontology Development provide the overall conceptual and abstraction context of the SSBMO compared to a generic business ontology.

Figure 3-17 builds on these earlier illustrations to provide the overall abstraction context of the SSBMO and relates this to the systematic design science methodology for its construction. Figure 3-17 also illustrates:

- The relationship between the overall type of methodology developed for the build and evaluation of the SSBMO
- Potential methods that could be used to create instantiations of the SSBMO (i.e. firm specific strongly sustainable business models)
- Operating firms that are attempting to create conditions for strongly sustainable outcomes to emerge.

Specifically Figure 3-17 shows how a systemic design science methodology is not only applicable to design the SSBMO, but may also be applicable to create business models that can be designed using the SSBMO, along with the implementation of those business models in operating firms. These latter two uses of the methodology are out of the scope of this research (2.6).

These assertions are believed to be correct because designing a new business model, or instantiating a business model are both “wicked” problems. Systemic methodologies (such as soft systems methodologies) are thus more likely to be more effective than other approaches to design Hence employing systems approaches to these tasks will help people (the multiple minds who are the organization’s stakeholders) create their conceptual model of their desired organization, help to bring it into reality and help sustain its existence, creating the desired outcomes.

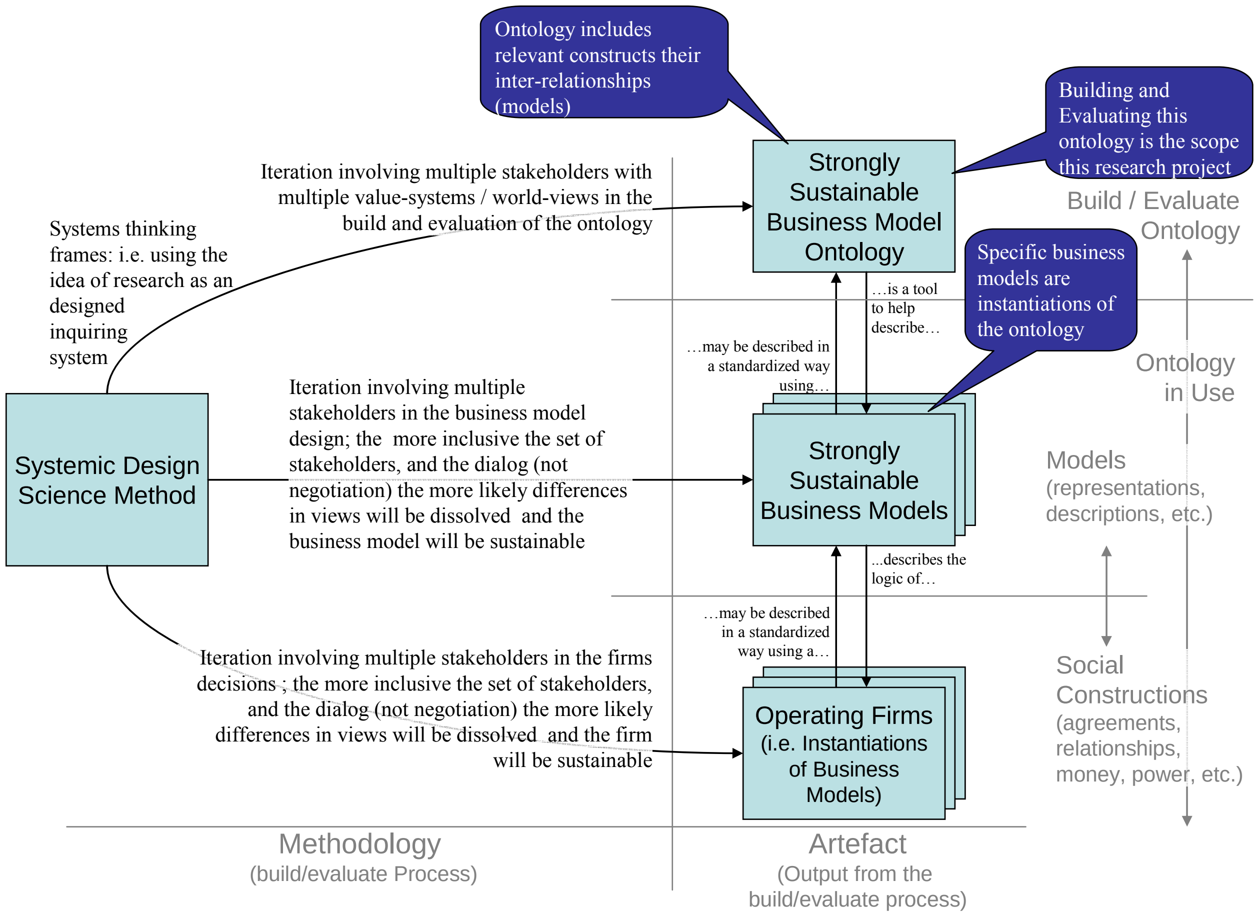


Figure 3-17: Systemic Design Science Method and Artefacts

Figure 3-18 shows the relationship between Baskerville et. al.’s Soft Design Science Methodology (introduced in 3.5.2.2 and illustrated in Figure 3-13), the systemic design science method and artefacts of this research (Baskerville et al., 2009).

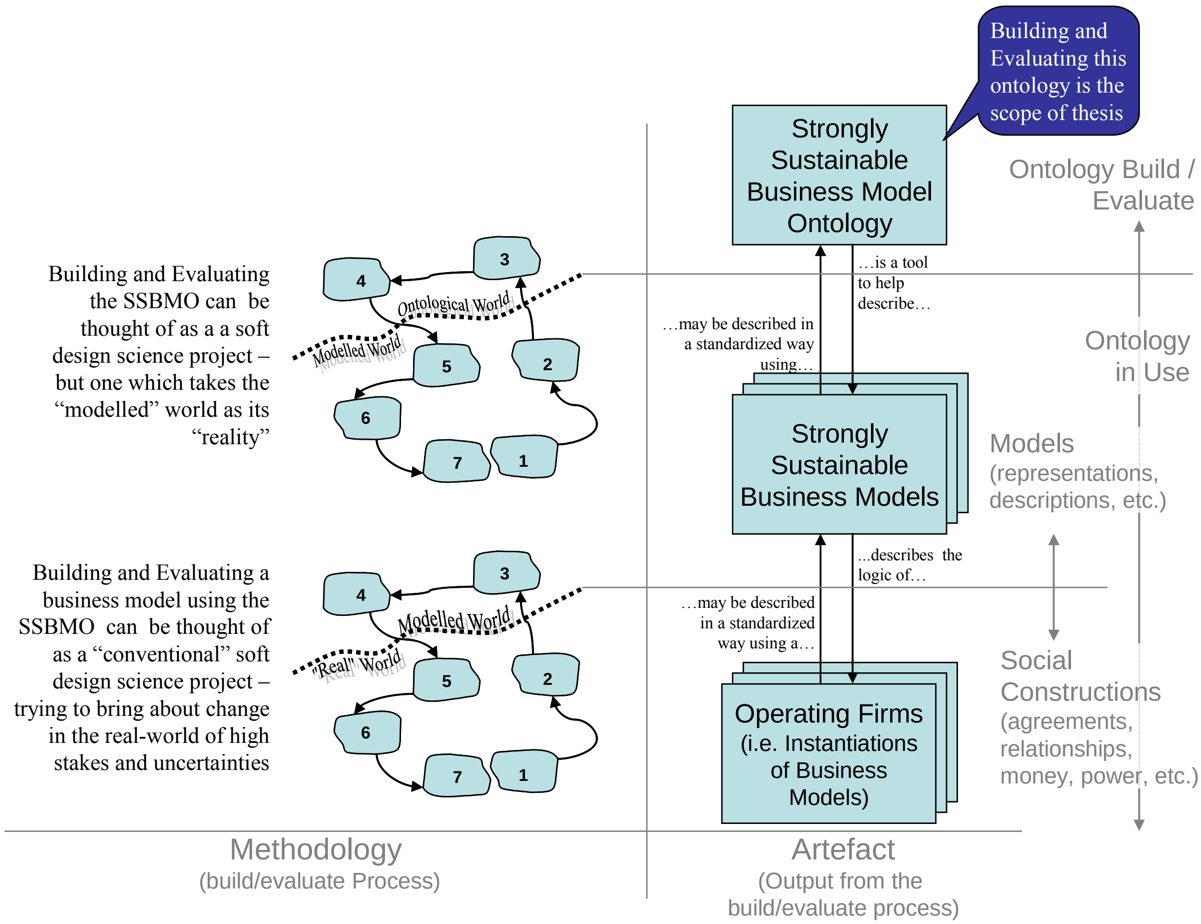


Figure 3-18: System Design Method and Artefact Detail

In reviewing the literature on epistemological approaches, the work of Funtowicz et. al. on "post-normal science" was noted to provide a useful framework for thinking about the development of the SSBMO, strongly sustainable business models and operating firms attempting to create conditions for strongly sustainable outcomes to emerge (Funtowicz & Ravetz, 1993).

While the development of the SSBMO has a high degree of uncertainty, it is perhaps not a high stakes project.[109] However, the development of business models using the SSBMO and their implications is significantly more risky with more degrees of uncertainty. While such work might still be considered "consulting" using Funtowicz et. al's framework, their

[109] Give the moral and practical urgency of the problem the reverse can be argued if it is assumed that the introduction of the SSBMO and SSBMC can, as per the motivation for this research, make a difference in the world. Hence this project is part of the development of a consulting service offering to be offered by the author's firm Edward James Consulting Ltd.

perspective suggests that an explicitly post-normal action research approach may be more applicable. This also fits nicely with the conceptualization of the "Third Generation" systems and design methodology proposed by Pourdehnad et. al and hence with the systemic design methodology developed for this research (Pourdehnad, Wexler, & Wilson, 2011a; Pourdehnad, Wexler, & Wilson, 2011b).

Finally, these descriptions of the conceptualization and abstraction involved in the creation of the SSBMO and SSBMC and its methodological context are clearly similar to these same aspects of the exemplar organizational ontologies introduced under 3.5.1.3; this further illustrates the antecedent role these exemplars provide for this research.

3.6.4 Achieving Research Rigor

Following the introduction of the overall research conceptual framework (3.2) and the choice of the design science epistemology (3.3-3.4) section 3.5 explored the challenges in undertaking this research in as rigours manner as possible.

This section now summarizes this aspect of the overall research design.

3.6.4.1 Applying Guidelines for Achieving Research Rigour

Attempting to maximize research rigor was informed by the influential guidelines for achieving information systems design science research rigor published by Hevner et. al. (Hevner et al., 2004). Further the exemplar researchers Al-Debei and Bullinger used similar approaches to ensure the rigour of their overall research designs (Al-debei, 2010, p.42; Bullinger, 2008, p.225 & p.232)[110].

The guidelines developed by Hevner et. al. to guide researchers in the process of creating rigorous information systems design science research was introduced Table 3-4: Attributes Conveying Legitimacy for Design Science Research Outputs (Hevner et al., 2004, pp.82-90).

Table 3-11 re-presents Hevner et. al.'s seven guidelines and adds a description of how the design of this research applies each guideline. This is used to introduce and summarizes the overall research design and allows its rigour to be analyzed.

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[110] Osterwalder was working on his PhD before Hevner et. al. published these guidelines had been published.

Guideline*	Description*	Application of Guidelines to SSBMO Overall Research Design
1. Design as an Artefact	Design-science research must produce an innovative purposeful (viable) artefact in the form of a construct, a model, a method, and/or an instantiation.	Resulting artefacts are the ontology and canvas for strongly sustainable business model design. These artefacts consist of constructs related in a model. Instantiations are created to aid in the evaluation of the validity and utility of the constructs and model.
2. Problem Relevance	The objective of design-science research is to develop an innovative purposeful artefact for a specified problem domain	The business problem addressed by the solution is increasing the quality (reliability, consistency, effectiveness) of strongly sustainable business models and the efficiency of business model designers who create them. This has the additional benefit of reducing the risks to managers in firms. An artefact with these properties has not previously existed.
3. Design Evaluation	Because the artefact is purposeful, it must yield utility (including quality and efficacy) for the specified problem, i.e. a design artefact must be rigorously demonstrated via well-executed evaluation methods.	Evaluation takes place by creating / capturing comparator knowledge via a number of techniques and then determining values of a set of metrics. See evaluation detailed research design (Chapter 6).
4. Research Contributions	Since the artefact must be innovative, novelty is crucial (solving a heretofore unsolved problem, or solving a known problem in a more effective or efficient manner), effective design-science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.	Contributions are expected from 1. The capture of novel key concepts and their inter-relationships that organization's should consider when attempting to be strongly sustainable 2. A novel tool that practitioners can use to more efficiently and effectively design organizations strongly sustainable business models. 3. A novel methodology for the creation of the artefact. Contributions are detailed in Chapter 10.

Guideline*	Description*	Application of Guidelines to SSBMO Overall Research Design
5. Research Rigor	The artefact itself must be rigorously defined, formally represented, coherent, and internally consistent. Design-science research relies upon the application of rigorous methods in terms of construction and evaluation of the artefact.	Guidelines from the field of Design, Systems Thinking and Information Sciences are followed during the creation of the domain ontology using a semi-formal language, e.g. the Ontology is formally represented using the Entity Relationship Modelling formalism (discussed in detail in the build detailed research design (Chapter 5).
6. Design as a Search Process	The process by which it is created, and often the artefact itself, incorporates or enables a search process whereby a problem space is constructed and a mechanism posed or enacted to find an effective solution. The search for an effective artefact requires utilizing available means to reach desired ends and satisfy laws in the environment.	Specific guidelines for ontology design and the science of design have been applied in the creation of the overall research design (this chapter) and detailed research designs (Chapters 4-6). The application of this approach is novel in the domain of strongly sustainable business models.
7. Communi-cation of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.	Results of research are presented to practitioners as well as to the research community during the evaluation activity stream. This is helped by one of the overarching purposes of an ontology – establishing a shared language to support understanding and problem solving

Table 3-11: Application of Guidelines for Undertaking High Quality Design Science Research

* (Guidelines by Hevner et al., 2004, Table 1 p.83 and description pp.82-90. Copyright © 2004, Regents of the University of Minnesota. Used with permission)

3.6.4.2 Applying Methods and Techniques to Make Choice Explicit

As described in the introduction to this part, and through-out this chapter, a key issue to ensuring rigor in design science is being as explicit as possible about choice and their basis.

In determined the overall research design, an attempt to be explicit has been made through the repeated application of the systematic search, reflect and apply process introduced at the start of this part. (As shown in Figure II-2, this same approach will be used for the choices involved in the detailed research design described in the remainder of this part). The evaluation of the utility of this approach comes from the use of the research design in the construction and evaluation of the artefacts.

During the execution of the overall research design how well choice is made explicit depends on the specific methods and techniques chosen Almost all existing research methods and techniques (literature review, case study, secondary data gathering, design interviews, etc.) can be used during design science prepare, build and evaluation activity streams.

Table 3-12 introduces the approaches chosen in the detailed research design of each activity stream and research method / technique that supports each choice. The search, reflect and apply steps used to make these choices will be described in the detailed research design of each activity stream (Chapters 4-6).

In summary in this research, as an act of design (at multiple levels), choice is required; elements of this work are inherently normative. However, based on the literature, through the exhaustive explicit description of those choices and their basis in the key theoretical frames an acceptable degree of rigour is possible.

Research Activity	Preference / Sequence	Approach to Justifying Design Choices	Chosen Research Method & Techniques
P. Prepare and D. Build	1st	Basing judgments on existing scientifically valid knowledge.	***Literature reviews*** will provide this evidence from a variety of key theoretical frames (K0, K0-SS, K0-PF) (described at the start of Chapter 4)..
	2nd	Explicitly recognizing judgments based on moral / ethical considerations	Given the state of sustainability knowledge noted earlier, in some cases there is not yet a weight of empirical evidence to legitimate one design choice over another. In these cases, ***literature reviews*** will provide evidence on both sides of the question as well as the moral / ethical principal which informed the design choice (described at the start of Chapter 4).
E. Evaluation of Artefacts	1st	Validating judgments with frameworks designed to test the level of sustainability of aspects of firms' business models.	This will be done through a ***static comparative analysis*** of these frameworks and the comparator knowledge sources K1…K3 based on the detailed research design for evaluation (Chapter 6).
	2nd	Validating judgments with experts with 'real-world' knowledge of sustainability and business models..	This will be done through ***interviews*** to gather the comparator knowledge sources K4…K5 based on the detailed research design for evaluation (Chapter 6).
	3rd	Validating judgments with managers in the "real world".	The ***case study*** method will be used to gather 3rd person feedback on the validity and usefulness of the design of the ontology from managers in firms by gathering through ***documentation review*** and ***interviews*** comparator knowledge source K6 based on the detailed research design for evaluation (Chapter 6).

Table 3-12: Research Methods and Techniques

3.6.5 Scope of Design Science Research Activities and Output Elements

Table 3-13 applies the recommendations by March, Smith and Vaishnavi (Table 3-5) to describe the scope of the design science research activity streams and the elements to be output by this research (March & Smith, 1995, p.255; With additions from Vaishnavi & Kuechler, 2009, p.6).

		Design Science Research Activity Streams		
	Output Elements	P. Prepare	D. Build (Develop / Design)	E. Evaluate (Validate)
Design Science Research Output	i. Constructs			
	ii. Models			
	iii. Instantiations			
	iv. Method			

Table 3-13: Scope of Design Science Research Activities and Output Elements
(Derived from March & Smith, 1995, p.255; with additions from Vaishnavi & Kuechler, 2009, p.6 as shown in Table 3-5)

The areas of the table shaded in green is the scope of this research
(boxes Pi-iv, Di-iv and boxes Ei-iv)

Given the exploratory nature of the research, and the time available, other activities and output elements identified by March, Smith and Vaishnavi are not in scope of this thesis (e.g. theorizing or formal justification via experiment or other quantitative approach).

The outputs of this research are:

1. An ontology for strongly sustainable business models consisting of a group of constructs and a model of those constructs relationships (SSBMO) evaluated by its use.
2. A visual, but conceptually compatible simplification of the SSBMO used in the evaluation of its utility to gather comparator knowledge, the strongly sustainable business model canvas (SSBMC).
3. Evaluated example instantiations of the ontology, showing the ontology in use to describe business models of firm's who claim to be attempting to produce various

levels of strongly sustainable outcomes (from none, profit first, to many, strongly sustainable).

4. A method for the building and evaluation of the ontology and its instantiations evaluated by its use.

5. The reviews of the literature which justify the method and the built and evaluated SSBMO.

3.6.6 Overall Research Design

Figure 3-19 applies the information systems research framework of Hevner et. al (Figure 3-6) to describe the overall research design. This follows the lead of exemplar researcher Bullinger (2008, p.231).

Figure 3-20 then shows and fully describes the final overall research design (the fourth pass). Finally Figure 3-21 shows the overall process of inquiry (project plan) view of the activity streams.

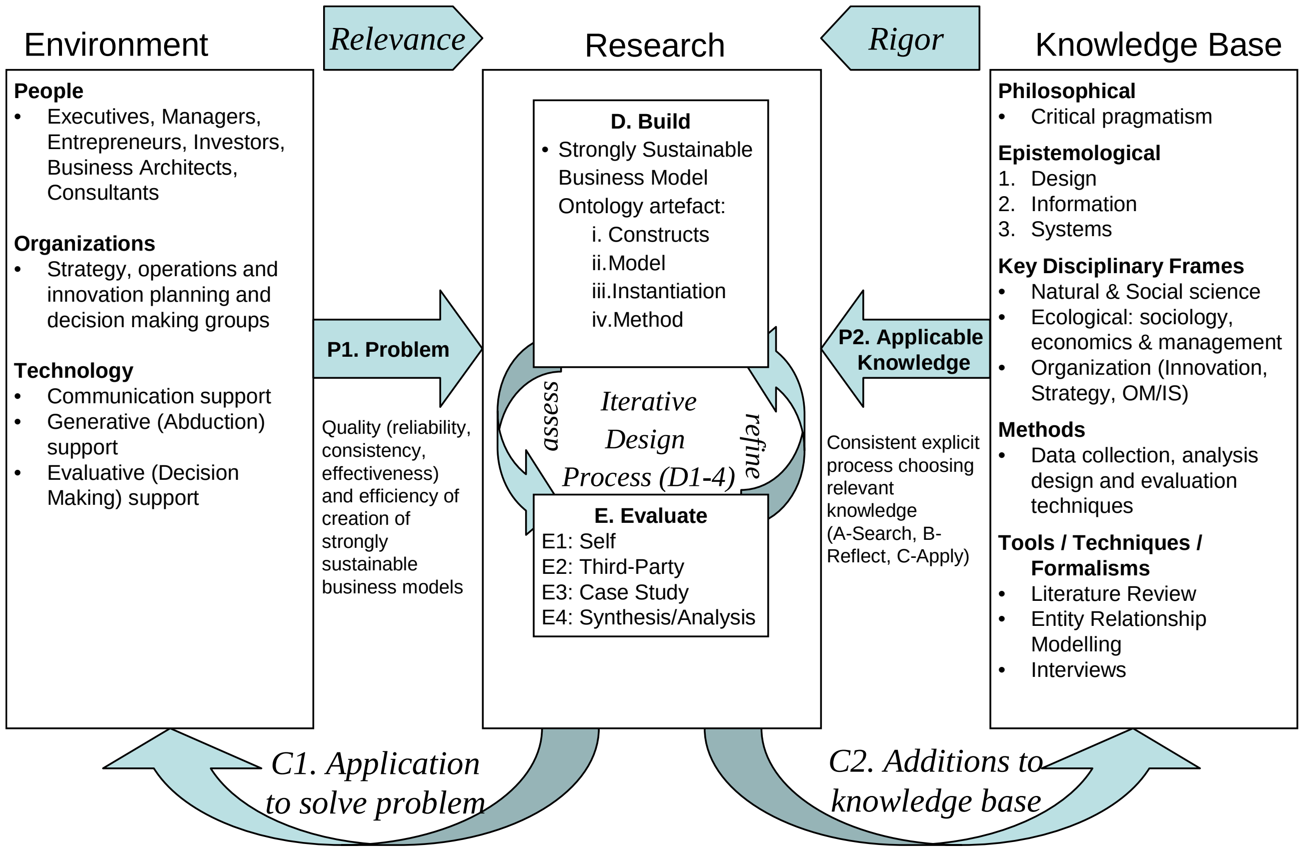


Figure 3-19: Conceptual Research Design
(Derived from Hevner et al., 2004, Fig.2 p.80 shown in Figure 3-6)

Using Figure 3-19, the conceptual process for this research is as follows:

1. The problem is understood (P1) and the applicable key theoretical frameworks are identified (P2) (the preparation activity stream).

2. Iteratively Build (D1-4) and Evaluate (E1-4) the artefact (the Build and Evaluation activity streams). On occasion this necessitates iterations back to the preparation activity stream.

3. Communicate the results of the research (C1, C2) (These activities are the Communication activity stream).

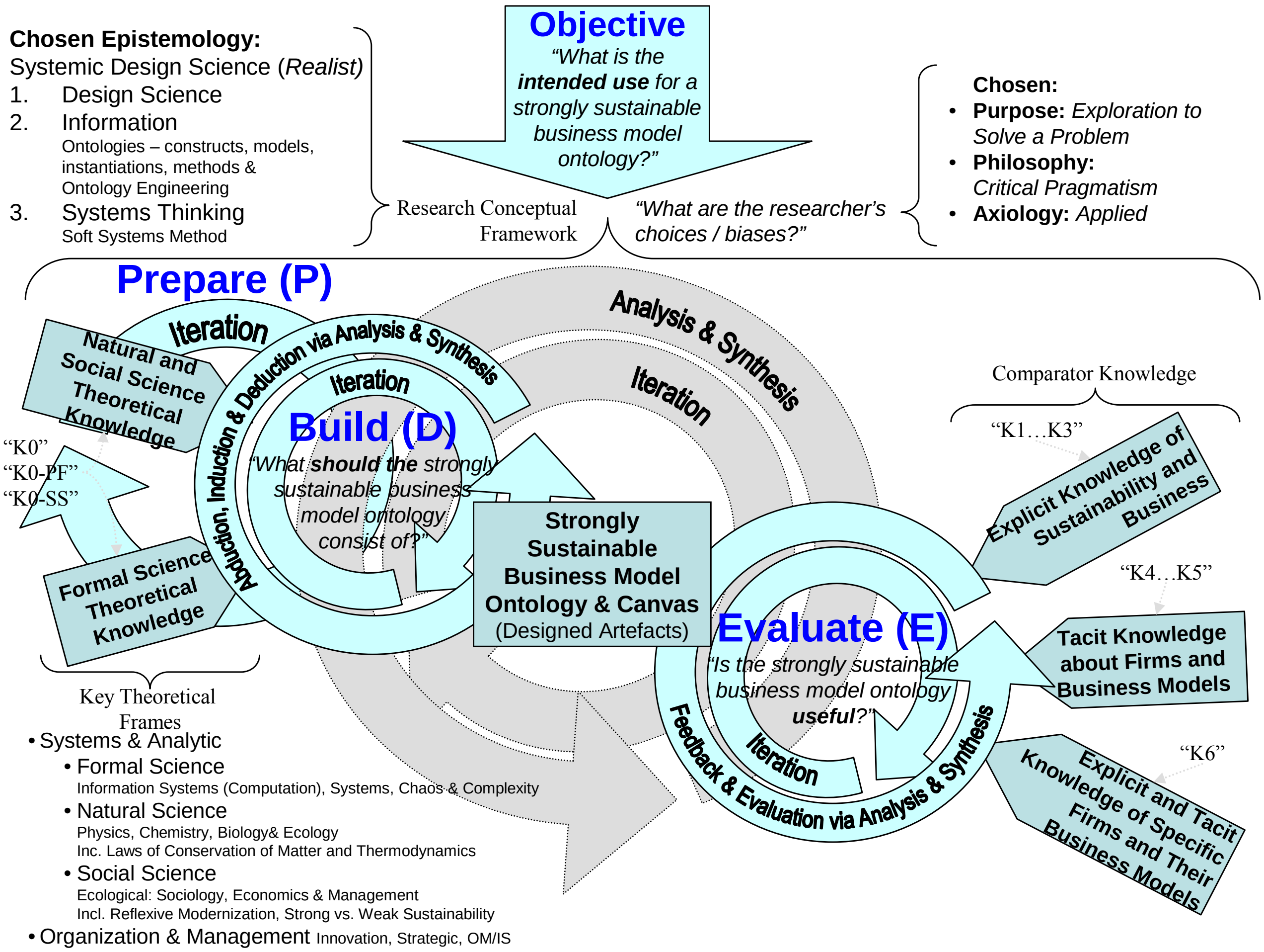


Figure 3-20: Final Overall Research Design (Fourth Pass)

Figure 3-20 repeats the final overall research design (pass four) built during this chapter based on a search of, reflection on and application of the relevant literature given the research objective.

All the terminology has now been aligned with the final terms used, following the introduction and definition of these terms in this chapter.

The overall research design is summarized as follows, starting from the middle of the top of Figure 3-20:

- The research objective is the overall context for this research and answers the question "what is the intended use for a strongly sustainable business model ontology?" (i.e. what problem is it to solve?) This leads to the overall research question:

RQ: Is it possible to design an ontology that can be usefully employed to describe a firm's strongly sustainable business model design?

- In answering this research question an overall Research Objective is that:

RO0: The research design will be of the highest quality possible: minimizing bias by maximizing rigour, hence maximizing the legitimacy of the research output.

- Further: the goal of answering the overall Research Question, and hence the business problem this research is looking to help managers solve, is how to:

RO1: Increase the quality of strongly sustainable business models

RO1a: Reliability,

RO1b: Consistency and

RO1c: Effectiveness

and

RO2: The efficiency of their production.

- The research conceptual framework identifies the key choices for the research design along with the researcher's biases based on these research objectives (shown top right and left in Figure 3-20):
  - Purpose: to explore to solve a problem in the world, i.e. an applied axiology
  - A critical pragmatic philosophical bias, i.e.

> If, upon critical examination, an ontological or epistemological perspective makes a practical difference in achieving the research objectives, as per the world-views of the researcher and/or managers in firms, it is to be considered.

  - A realist epistemology, and within this the integration of:
    - Systemic design science, consisting of four activity streams, (prepare, build, evaluate and communicate), each involving abduction, induction and deduction.

> Systemic design science creates knowledge based on the experience gained from the rigorous construction and evaluation of artefacts, using the best available knowledge and the techniques of synthesis and analysis, that are useful to managers solving problems.

    - The formal science of information (computation), specifically ontologies as a type of artefact (consisting of constructs, models, instantiations and methods), of high utility to managers, and the associated methodologies / techniques from Ontology Engineering.
    - The formal science of systems thinking, specifically leveraging Soft Systems Methodology. Hence the four activity streams interact with each other iteratively over time and involve analysis and synthesis during these iterations.

- The discussed proximities in the literature between design science, ontology engineering and soft systems discussed in this chapter support the integration of these three approaches in this research design.

- Moving to the centre of Figure 3-20: in this research:

A “profit-first” organization is one in which monetary profit is the sole legitimate objective; success is defined in terms of attempting to maximizing monetary profit at all times and over time

and

A “strongly sustainable” organization is one in which all of its behaviours and all the behaviours of all other relevant social, economic and biophysical actors, lead to the possibility that human and other life will flourish on the planet forever.

- Hence, the artefacts to be built and evaluated are:

An ontology: an explicit partial account of a shared conceptualization of any possible strongly sustainable business model (the SSBMO).

and

A strongly sustainable business model canvas (the SSBMC): a simplified visually attractive tool powered by and hence conceptually compatible with, the SSBMO.

– The unit of analysis is the business model of an organization, defined as:

A description of the rationale of an organization's existence: who it does it for, to and with, what it does now and in the future, how, where and with what does it do it, and how it determines and measures its success.

or

A description of how an organization can succeed over time

– To maximize the utility of these artefacts the following two ontology design principles must be followed in their creation:

ODP1: The strongly sustainable business model ontology is based on and is compatible with the latest natural, social and formal science knowledge on strong sustainability – its definition and achievement.

ODP2: The strongly sustainable business model ontology and the tool it powers take an empathetic stance towards its users, their knowledge and beliefs: it does not prescribe; it does not require the user to change their world-view or value system in order for them to derive some of the artefacts' designed utility.

– Hence

The SSBMO and the SSBMC it powers must be able to describe business models conceived from world-views anywhere on a continuum from profit-first (K0-PF) to strongly sustainable (K0-SS).

- and

> The SSBMO and the SSBMC it powers, are a “domain ontology” comprising the constructs, models (the relationships between the constructs) and instantiations, expressed in a semi-formal language, determined to be relevant.

- Moving to the circular arrows surrounding the prepare (P), Build (D), and Evaluate (E) activity streams in the centre of Figure 3-20. The systemic design science epistemological approach requires the following steps to be carried out iteratively in each activity stream:
  - Prepare identifies the key theoretical frames (K0, K0-PF, K0-SS) relevant to the research objective by answering the question “what could a strongly sustainable business model ontology consist of?”
  - Build takes the key relevant theoretical frames (K0, K0-PF, K0-SS) to iteratively analyze and synthesize (using abduction, induction and deduction) the problem and solution domains in order to answer the question: “what should the strongly sustainable business model ontology consist of?
  - Building results in the creation the SSBMO and the visual tool it powers, the SSBMC – the designed artefacts from this research.
  - Evaluation iteratively gathers, using the SSBMO and SSMBC and other techniques relevant comparator knowledge (K1…n). Evaluation then uses the comparator knowledge to determining the utility of the SSBMO to the research objective: “Is the strongly sustainable business model ontology useful?” Feedback on utility is created via analysis and synthesis.
  - The build and evaluate activity streams are undertaken iteratively (shown as the circular arrows behind the build and evaluate activity stream). After a number of iterations (determined by requirements of rigour and practical considerations of time and effort) the research concludes with the identification of changes to the

final iteration of the SSBMO identified in the final iteration of the evaluation activity stream.

  - Communication of the knowledge gained goes on during and continues after the other activity streams (not shown in the figure).

- These activities streams must together answer the following research questions, refinements of the research question and objective:

RQa: How can strong sustainability emerge as an outcome of an organization understood as a multi-minded ideal-seeking purposeful system (analysis), and what systems contain / provide context for an organization so understood (synthesis)? (Answered in Chapter 4 – Prepare)

RQb: How can such an understanding be modelled using an ontology in order to enable a tool useful for managers attempting to design the conditions from which strongly sustainable outcomes may emerge from and for their organizations? (Answered in Chapter 7 – Research Output)

- Moving to the arrows on the left and right of Figure 3-20 shown as inputs to the build and evaluate activity streams respectively: To build and evaluate the SSBMO and SSBMC requires knowledge.

"Key Theoretical Frames" consist of knowledge determined to be most practically relevant to the problem and solution domains implied by the research objective.

– The key theoretical frames (K0, K0-PF and K0-SS) draw from the following organization and management fields:

- Innovation
- Strategy
- Operations Management (OM)
- Management Information Systems (MIS)

Additionally the key theoretical frames also draw from fields which take a systems (i.e. ecological) stance, i.e.:

- Formal science – information systems (computation), systems, complexity and chaos (i.e. theorization which supports the processes of analysis and synthesis required to design the research, build and evaluate the ontology artefact and subsequently use it in practice).
- Natural science – Physics, Chemistry, Biology, Ecology (i.e. evidence on what constitutes strong sustainability from a biophysical perspective)
- (Environmental) Social science (i.e. evidence on what constitutes strong sustainability from a social perspective)
- (Ecological) Economics (i.e. evidence on what constitutes strong sustainable from a economic (financial / monetary) perspective

To be useful and valid the ontology synthesizes knowledge from all these key theoretical frames, K0, which includes K0-PF, and K0-SS.

"Comparator Knowledge" informs solution utility and comes from the user's experience of the solution in light of their tacit and explicit knowledge.

– To enable the utility of the SSBMO to be evaluated requires gathering various types of comparator knowledge (K1..n) from users who experience the SSBMO and its instantiations (in some cases expressed via its visual simplification, the SSBMC):

  - Explicit knowledge of business and sustainability (labelled K1, K2 and K3)
  - Tacit knowledge about firms and business models (labelled K4 and K5)
  - Explicit and tacit knowledge of specific firms and their business models (labelled K6).

Summarizing:

Based on the above, to answer the research question and meet the research goal, this research undertakes an exploration, using a systemic design science approach, to:

Build, based on a literature review, a SSBMO that can be usefully employed to describe business models conceived from world-views anywhere on a continuum from profit-first (K0-PF) to strongly sustainable (K0-SS).

Evaluate the design of the SSBMO using a variety of research methods, including comparative analysis, interviews and case studies, to gather user's perceptions of its utility (completeness, quality and beauty).

This summary is updated at the end of Part II to include the details developed in the prepare, build and evaluate detailed research design (Chapters 4-6).

3.6.7 Boundaries of the Artefacts

The SSBMO and SSBMC it powers have the following common conceptual boundaries. The SSBMO and SSBMC must include the constructs and a model which relates them required to describe:

- The systems which contain a firm
- The systems which comprise the parts of a firm
- The systems which as a whole need to be sustained and might be negatively impacted based on a firm's behaviours

This requires that the SSBMO and SSBMC it powers must be able to describe the:

- ***The social definition of a firm's boundary*** based on the agreement of the firm's purposes made by all the multiple minds involved in the firm. The agreed purpose is based on a sub-set of the minds' needs that the firm will meet.
- ***The legal definition of a firm's boundary*** is based on the concept of 'ownership' and the concept of the firm as a 'legal person' (with the rights and obligations this entails).
- ***The systems outside a firm's boundary*** are the system of systems of which a firm is a part (including other firms, communities, the biophysical environment and from eco-system services, and the human constructed social and monetary domains).
- ***The systems within a firm's boundary*** are those aspects of the system of systems which comprises the firm which are relevant (i.e.. the system of a firm's business processes).
- ***The conceptual (knowledge), social (relationships) and 'objective' (physical) artefacts inside a firm's boundary*** are those that need to be 'owned' or 'controlled' by the firm to fulfill the firms' agreed purposes (broadly the firms capabilities and resources).

- ***The social (relationships), physical and conceptual artefacts which are'"shared' with stakeholders via the containing systems***. These are described in (formal) agreements with stakeholders, and are realized in various types of flows: monetary flows with stakeholders (investments, revenues, payments, interest, dividends), bio-physical material flows to and from bio-physical stocks and eco-system services, as well as energy flows to and from the biosphere.

Following the literature review of the key theoretical frames in the preparation activity stream (Chapter 4) and the development of the build and evaluation activity stream detailed research designs (Chapter 5 & 6), in Chapter 7 the designs of the SSBMO and SSBMC are described, bounded as described above.

3.6.8 Overall Research Process

Creating a rigorous process of inquiry, or project plan, for this research was informed by:

- Practical experience (efforts that are planned are more likely to be successfully completed) and
- The approach taken by exemplar organizational ontology researchers:
  - Al Debei used Kuchler and Vishnavi's Design Science Research Cycle to develop their own research project plans (Al-debei, 2010, p.21),
  - Bullinger used research cycles from the ontology engineering field which are highly similar (Bullinger, 2008,"1.1 Ontology Engineering" pp.199-215, p.207, p.232)[111].

[111] Osterwalder had completed his PhD before this research cycle had been developed.

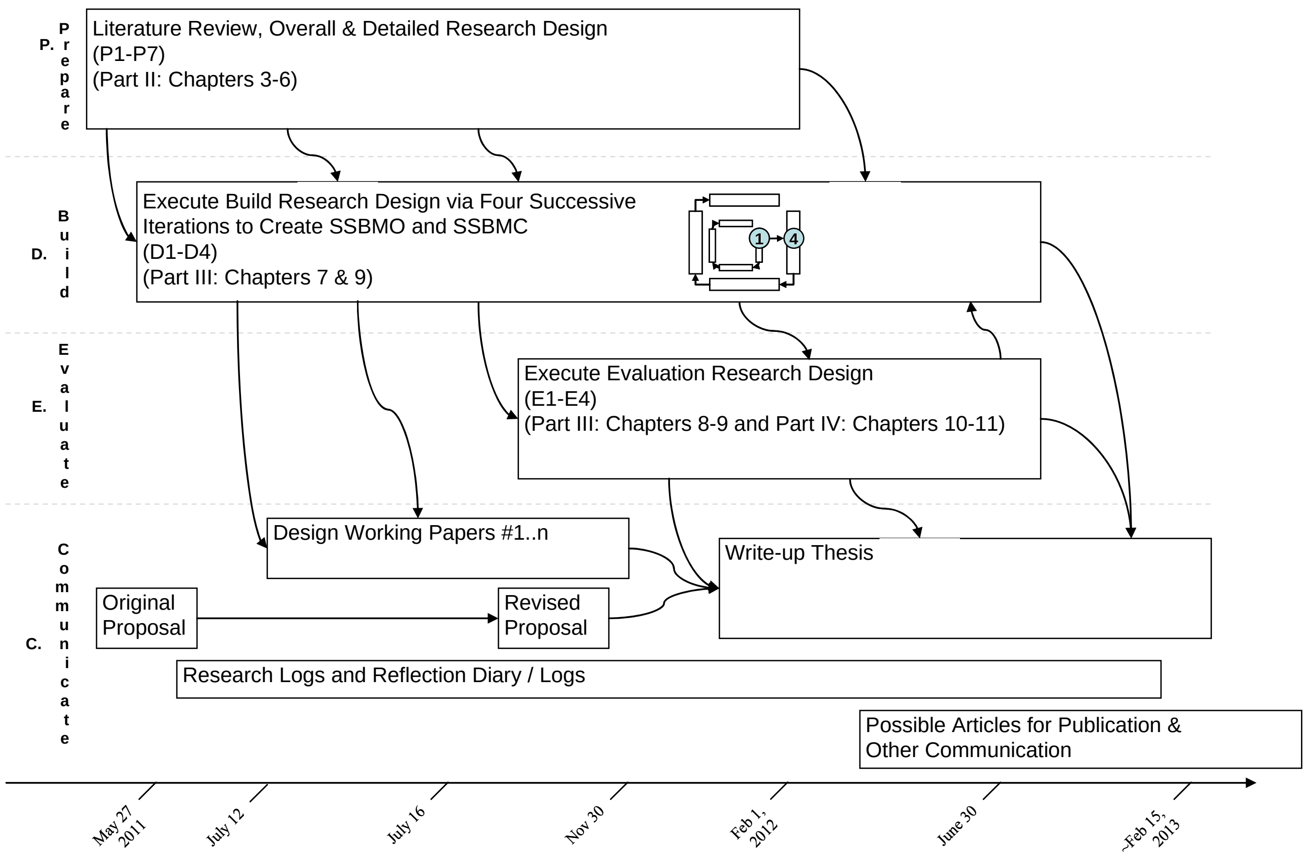


Figure 3-21: Overall Research Process

Figure 3-21 shows the overall process of inquiry (project plan) view of the activity streams inspired by the above, and explicitly considering the advice of:

- Kuechler and Vaishnavi's research cycle (Figure 3-7)
- Hevner et. al.'s research guidelines and framework (Table 3-11 and Figure 3-19) and
- March, Smith and Vishanvi's research activities and output elements (Table 3-13).

The process inquiry consists of

- four related “swim lanes” one for each of the four activity streams Prepare (P), Build (D)[112], Evaluation (E) and Communicate (C)
- Activity groups within each activity stream (Seven in prepare P1-P7, four in Build D1-D4 and four in Evaluate E1-E4)

The task structure within each activity stream, the activity groups, are explained in the detailed research designs for each activity stream.

Within this swim lane structure the practical sequence of this research project is as follows:

1. The original project proposal is written and approved (MES II-III exam May 27, 2011) (C).
2. The templates to capture the research logs, reflections, and research diary are established and start to be used (C).
3. To understand the problem and the applicable knowledge, the “key theoretical frames” (K0) start to be identified, which will be required to build and evaluate the SSBMO (P)
4. Using the initial output from the literature review a first version of the SSBMO artefact (constructs and model) is built (D) and described in the Design Working Papers (C). The build activity uses an iterative systems thinking approach examining the function, structure, process and context of business models.
5. Details of the SSBMO artefact are captured in the initial version of the “Design Working Papers” (C).
6. Based on learning from the first version of the SSBMO further literature review work is undertaken (P) and a second version of the SSBMO artefact is built (D) and described in the Design Working Papers (C). Again an iterative systems thinking approach is applied to this build activity.

[112] Build is perhaps synonymous with Design (as a verb), hence the label D for the activities in this activity stream.

7. Based on learning from the second version of the SSBMO further literature review work is undertaken and an initial third version of the SSBMO artefact and an first version of the SSBMC are built (D3 is started) and described in the Design Working Papers (C). Again an iterative systems thinking approach is applied to this build activity.
8. Based on the accumulated learnings a revised project proposal is prepared, reviewed and approved (August 8, 2011) (C).
9. The detailed research design of the evaluation activities is determined and documented (P, E & C).
10. The Comparative Analysis and Informal Third Party Review Evaluation activities are undertaken (E) and written up (C).
11. Based on the learning from evaluation activities (E) as well as the learning from the initial work on the third version of the SSBMO and the first version of the SSBMC the SSBMO artefact is finalized (D) and described in the Design Working Papers (C).
12. Using the completed third version of the SSBMO the Formal Third Party Review and Case Study evaluation activities are undertaken (E) and written up (C).
13. Based on the learning from evaluation feedback synthesis & analysis activities (E) the feedback that could be used to revise the SSBMO is prepared (D).
14. The final write up of all aspects of the project is then undertaken (this thesis document), and submitted for review and approval (C).
15. Activities to communicate the results of the thesis work to practitioners and academics are then undertaken (C)

A detailed version of the process of inquiry is presented at the end of Part II to include the details of the activity groups within each activity stream developed in the respective detailed research designs (Chapter 4-6).

3.6.9 Researcher Bias

As per the summary of the literature presented at the start of this part, it is important be as explicit as possible about how choices are made in the design of the research and the design of the artefact. Hence explicitly identifying sources of researcher bias is an important component of ensuring rigour and hence maximizing legitimacy of the research output.

3.6.9.1 Normative Definition of Sustainability

A clear potential source of bias results from the established normative nature of the research topic (3.4.6.1). Hence this researcher:

1. Accepts the moral argument that he needs to play his small part to increase the speed by which humanity understands and then can make the changes to improve our sustainability.

   This requires some researchers to try to create knowledge by choosing to look forward in time.

2. Believes future oriented research, when conducted appropriately (such as by using a systemic design science approach), is complementary to knowledge produced by descriptive science (which looks back in time and studies phenomena which have occurred), and is justified, at least in part, because of the nature issues at stake.

   Taking a design approach to knowledge production, and then inspiring managers to act in alignment with this new knowledge, might create examples in the 'real world' that help humans and other life to flourish, which then can be studied by descriptive science to develop more comprehensive theory.

3.6.9.2 Philosophical Bias

This researcher has a predisposition to positivist approaches and perspectives based on his original training in the discipline of computer science. This was often reinforced by the philosophically Western (and highly academic) environment in which he was brought up (both parents were academics/teachers).

While his practical experience in business for the past 20+ years has provided ample explicit and tacit knowledge and experience that suggests the validity of the constructivist / subjectivist world-views it remains a conscious effort to ensure these perspectives are consistently considered.

In this research an attempt is made to consistently take a critically pragmatic (realist) stance. This attempt recognizes that both objective and subjective approaches can be valid, and provides a framework to make such choices (i.e. the practical implications of each choice).

3.6.9.3 Disciplinary Bias

From his original academic training in computer science the researcher recognizes he has an implicit and explicit affinity with the research techniques of this discipline. Specifically:

1. *The concept, mental and descriptive tools of abstraction* is widely used throughout this research design and the creation of the artefacts.
2. *Design* is the primary mechanism to gain understanding of the research problem and solution domains.
3. *Notations and diagramming conventions* are used to document and share the ontology and the tool it powers. Specifically, the ontology is described using the well known Entity Relational Modeling (ERM) technique (described in the build activity stream detail design – Chapter 5).

3.6.10 Identified Difficulties and Risks

The reflection steps undertaken in the construction of the overall research design also identified the following risks, methodological and practical difficulties.

Other than the elements of the overall research design, it is acknowledged that these risks are not removed, only that attempts to mitigate them are made. This is accomplished by the thoroughness of the research design.

- R1. It is cognitively hard to consistently maintain a critically pragmatic philosophical stance (3.6.9.2).

R2. This research is necessarily inter- or possibly even trans-disciplinary because of the real world problem it seeks to improve. This is evidenced by the key theoretical frames and body of knowledge consulted to construct the overall research design and artefacts.

In common with all work which attempts to cross and/or bridge disciplines risks arise due to the conflict between: where to stop digging (depth) and hence missing some critical understanding of a disciplinary theory, the need to invest time to go wide (breath) and avoid missing an entire critically relevant discipline, and practical limits of researcher time and cognition (3.2.3.5).

As per the critical tradition, reflecting upon these ideas identifies that pragmatics will drive the depth and breadth of both theoretical knowledge which can be brought to bear and comparator knowledge that can be gathered during this research.

One possible outcome (which may be revealed by evaluation of the artefacts) is that some key theoretical knowledge was 'missed' entirely or not sufficiently understood. Alternatively, failing to gather appropriate comparator knowledge may result in such problems remaining undiscovered. These are risks to the validity of the knowledge produced by this research.

In this research it is acknowledged that these risks are not removed, but attempts to mitigate them are made. This is accomplished by the thoroughness of the research design and the attempt to follow it.

R3. The "messy" and possibly "wicked" nature of the problem and solution domains (3.4.3) means it is going to be cognitively challenging to consistently:

- Take the steps identified in the research design that attempt to maximize rigor.
- Keep in mind the some-what contradictory world-views that underpin the profit-first and strongly sustainable key theoretical frames and all the implications of each.

R4. The necessary mutability of process and artefact (due to the iterative process) makes it challenging to design this type of research in detail before undertaking the research activities. This clearly limits the ability of rigour to reduce the risks identified above.

However, much can be learned from the comparison of planned activities vs. activities deemed required by the researcher in the moment; the results of such an evaluation of the research design can be a methodological contribution. The evaluation of the research method is described in Chapters 8 and 9 along with the results of evaluating the artefacts. Methodological contributions are described in Chapter 10.

3.6.11 Meeting the Research Objectives and Testing the Working Hypotheses

Finally, recalling the overall objective for this research (2.2, with detail in 3.6.6) and the working hypotheses (2.4): this chapter has presented evidence that the research question can be answered in the affirmative that the working hypotheses are confirmed and the axioms remain without controversy.

Specifically confidence is good because of the presented rationale for choosing and the choice of the:

- The overall research conceptual framework (3.2) and design science epistemological approach (3.3-3.4).
- SSBMO and the SSBMC it powers as the artefacts to be built and evaluated in this research (3.5.1).
- Systemic key theoretical frames (3.5.2 and 3.5.3).
- Methods and techniques to ensure rigor in the preparation, build and evaluation of the strongly sustainable business model ontology (3.5.2 and 3.5.4).

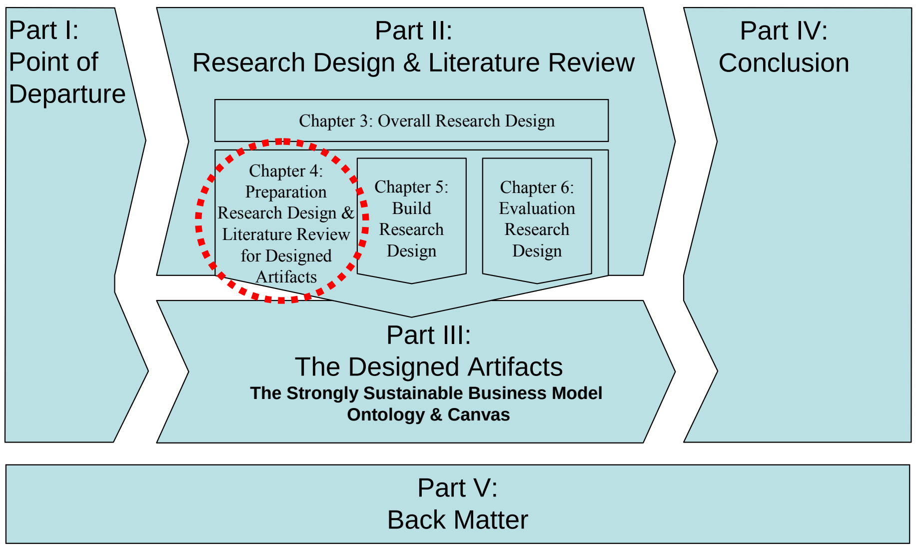
3.7 Introducing the Research Detailed Designs

The overall design of this research design is established. Now the description of the detailed research designs for the prepare (Chapter 4), build (Chapter 5) and evaluate (Chapter 6) activity streams is presented. This includes the searches, reflections and application of the literature that leads to the definition of the activity groups within each of these activity streams.

In addition, to present the details of the build and evaluate activity research designs requires the results of all the preparation activity stream activity groups. Hence the detailed review of key theoretical frames (leading to the identification of a number of detailed design principles for the SSBMO), undertaken during one of the preparation activity groups, is also included in Chapter 4.

Chapter Four: Preparation Research Design and Literature Review for Designed Artifacts

There's no sense being exact about something if you do not even know what you're talking about — John von Neumann



Within the context created by the overall research design set out in the previous chapter, this chapter has two segments.

1. The detailed research design for the preparation activity stream is determined. This identifies the activity groups along with the specific methods and techniques to be used to ensure rigour in the execution of the preparation activity stream.

2. The results of executing one of the preparation activity groups are described[1]: the identification of detailed design principles for the SSBMO. This detail is required for the detailed designs of the remaining two activity streams: build and evaluation (Chapters 5 and 6)

[1] As noted in II-3, for comprehendability, the results of executing the other preparation stream activity groups are described in earlier or later chapters (4.2.3).

The three step process, search (A), reflect (B) and apply (C), set-out at the start of this part are used to attempt to achieve rigour and hence maximize the legitimacy of the outputs of both segments.

4.1 Introduction

This chapter describes the creation of the preparation detailed research design and the execution of one of its activity groups. In doing so this chapter describes a set of choices that contribute to the meeting of the research objectives (see 3.6.6) by responding to the question:

How to best undertake the preparation activity stream with the greatest rigour possible?

To answer these questions the three steps set-out at the start of this part (A-Search, B-Reflect, C-Apply) are used repeatedly.

Firstly, as recommended by the literature on rigour reviewed in chapter 3 (3.5.4), they are used to create the detailed research design for the preparation activity stream.

Secondly, this detailed research design embeds the use of the three steps to ensure rigour during its execution.

These steps are used to operationalize the portions of the systemic design science methodology relevant to the preparation activity stream identified in Chapter 3 (3.5.4)

4.1.1 Chapter Structure

This chapter has two segments.

1. The detailed research design for the preparation activity stream is determined (4.2). The search (A) of the literature that describes approaches to preparing for the creation of artefacts is presented (4.2.1). From this search, a reflection (B) on the advice is described (4.2.2) in light of the overall approach to systemic design science research (3.5.4). The reflection is then applied (C) to design the preparation activity stream of this research (4.2.3). Seven preparation activity groups are identified (P1-7).

2. The results of executing preparation activity group (P4) are described (4.3-4.6) and summarized (4.7). The three steps are used three times to search (A) the literature for the relevant details of the key theoretical frames from each of three world-views: shared (K0), profit first (K0-PF) and strongly sustainable (K0-SS). From this search (A), reflections (B) that apply (C) this understanding to identify the detailed design principles for the SSBMO are presented. Next, a further reflection, entitled: "Towards a Theory for the Conditions Required for Strongly Sustainable Organizations" based on the same literature is outlined (4.7). This segment concludes (4.8) with a review of the working hypothesis (WH1-4), established in 2.4, in light of the literature reviews conducted during the preparation activity stream.

Finally, section 4.9 concludes this chapter by summarizing the preparation detailed research design.

4.2 Detailed Design of Preparation

This section presents the first segment of this chapter:

- The search (A) of the literature that describes approaches to preparing for the creation of artefacts (4.2.1).
- A reflection (B) that applies (C) the choices made to create the detailed research design of the preparation activity stream, including the identification of the seven preparation activity groups (P1-7) (4.2.2-4.2.3).

4.2.1 Searching for Best Practices to Undertake Preparation

Uncovering and analysing the literature on how to best undertake preparation in systemic design science research has turned out to be a significant process: the relevant literature comes from multiple fields. Further it has become clear that the literature on how to best undertake design science preparation is far from comprehensive and far from prescriptive (and perhaps can never be).

4.2.1.1 Reviewing the Literature

With the objectives of this research in mind and in the context created by the overall research design, this section reviews the literature related to the preparation for the creation of:

- Ontologies and other Information Systems artefacts (from Ontology Engineering, Management Information Systems and Computer Science),
- Design science artefacts (from Design Science)
- Organizational ontologies that have been produced through design science research (from the exemplars introduced in 3.5.1.3), and
- General requirements and specific solutions (From Soft Systems Methodology Research as shown in Figure 3-13).

This sub-section is organized as follows:

1. Definitions of and broad perspectives on preparation are reviewed.
2. Views on the purposes of the preparation process are presented.
3. Views on the processes that can be used to prepare for the creation of artefacts are discussed.
4. The inputs of knowledge required for preparation are described.
5. The outputs of knowledge from preparation required to create artefacts evaluated as having high utility are described.
6. The methods and techniques that may be used to undertake preparation are described.

The next sub-section (4.2.2) describes how the preparation detailed design for the SSBMO was chosen based on a reflection and application this literature. The subsequent sub-section (4.2.3) provides the details of the chosen preparation detailed research design.

4.2.1.2 Preparation: A Definition

Gause and Weinberg's late 1980's digital information systems and product design monograph "Exploring Requirements: Quality before Design" highlights the importance of understanding requirements in order to subsequently create artefacts of high utility. These authors suggest that design is a process of transforming desires into artefacts that satisfy those desires.

In the same vein Ackoff observed that successfully solving "messy" problems first and foremost requires considerable effort to identify the problem before beginning to create solutions (Ackoff, 1974, pp.4-11).

This leads to the following definition:

> Preparation is that part of design in which an attempt is made to discover what is desired (Gause, 1989, p.xv).

That the definition of preparation 'only' attempts to discover desires aligns with the interpretive ('soft') systems approaches. In these approaches it is assumed that a singular 'correct' design is impossible to know. Desire is dependent on the "different perceptions of the situation"; hence the focus must be on the attempt to learn about desires from multiple perspectives (M. C. Jackson, 2000, Introducing Checkland's Soft Systems Methodology pp.246-251). In this context it is clear why Gause and Wienberg suggest that when it comes to discovering desires:

> *The discovery is nothing; the discovering (the exploring) is everything* (Gause, 1989, p.xvi)

4.2.1.3 Purpose / Objective of Preparation

Writing in a seminal information systems design science article March and Smith state that it is important for researchers to explain to other scholars and practitioners the knowledge upon which the artefact is created. Without such explanations there is no basis to judge legitimacy and many aspects of utility (March & Smith, 1995).

Hevner et. al's Information Systems Framework (Figure 3-6) and Guidelines for ensuring legitimacy (Table 3-4) and Kuechler and Vaishnavi's Design Science Research Cycle (Figure 3-5) suggest that in the context of an academic information systems design science research project what must be desired is the rigorous:

- Identification and understanding of:
  - The problem domain: A problem and its context.
  - The solution domain: An ideal future state (i.e. an improved but as yet undefined future).
  - The key theoretical frames relevant problem and solution domains.
  - The methods and techniques to identify and understand the above.
- Definition, construction, evaluation and communication of an innovative purposeful artefact that is useful in the achievement of the desired ideal future state (Hevner, March, Park, & Ram, 2004; Kuechler & Vaishnavi, 2008).

Summarizing this literature, it would seem that:

> The purpose of preparation within systemic design science research is to rigorously attempt to identify and understand the problem and solution domains – function, structure, process and context[2].

[2] As per the Gharajedaghi and Miettinen's advice on the aspects of a system that must be iteratively examined through these four lenses to attempt to rigorously develop an understanding (Figure 3-15). Implicitly this includes what is understood and how to best understand.

4.2.1.4 Process of Preparation

Deep Questions

Gause and Weinberg, from a digital information system and product design perspective assert that there are multiple deep questions inherent in any process that attempts to know what is desired (Gause, 1989, p.xv):

- Who desires and why?
- What is a (legitimate) desire: a need and / or a want?
- How does a (legitimate) desire arise?
- How can the discovery of a (legitimate) desire be best accomplished (reliably, consistently, effectively)?
- Once an artefact that purports to satisfice a (legitimate) desire exists (and/or is used), does the desire remain, or remain unchanged?
- How can a discovered (legitimate) desire be best described so that it can be used to build an artefact that meets that desire (reliably, consistently, effectively)?

These are analytic perspectives on the process of attempting to know what is desired. This assumes desire is a whole which can be best understood through the identification of its contained parts and their inter-relationships.

As introduced in chapter 3 (3.5.2.2) systems thinking suggests additionally considering synthesis. This leads to additional deep questions concerning the context for the desires and the interrelationships of these contexts:

- Do all actors[3] have the same desire?
- Are desires convergent or divergent across multiple actors, places and / or times?
- How can divergent desires best be reconciled in a single artefact?

[3] Used as per Actor Network Theory (ANT) – actors may be human or non-human (Latour, 2005).

Practitioner Responses

Gause and Weinberg attempt a response to their analytical deep questions for digital information systems and product design practitioners: unfortunately their response focuses on processes and techniques for teams to use to gather requirements from people (groups and individuals) not an individual seeking to understand desires from relevant key theoretical frames described in literature.

Design Science and Ontology Engineering Responses from the Exemplar Organizational Ontologies

The three exemplar organizational ontologies introduced in 3.5.1.3 created using design science and ontology engineering approaches all implicitly or explicitly included a preparation activity. This activity was aligned with attempting to answer at least some of the deep questions above. In the creation of the research design for their preparation activities:

- Osterwalder takes an Information Systems approach to consider the purpose and activity of preparation. He focuses on the review and selection of appropriate preparation methods and techniques for the development of the research outputs as defined by Smith and Vaishnavi (Table 3-5). He selects library research and literature analysis as the methods for his preparation activity (Osterwalder, 2004a, p.7) and subsequently describes how the outputs of these techniques were used during the build activity (pp.44-46).

- Bullinger frames preparation from the Ontology Engineering perspective. She considers the purpose and activity of preparation as “all the activities necessary [prior to the development] of an ontology” and that this requires “an analysis of the knowledge bases” for both methodology and domain knowledge as well as the “identification of usage scenarios” and “relevant stakeholders”. Like Osterwalder she then focuses on the methods and techniques to be used: library research and literature analysis. She then adds a feasibility study to identify usage scenarios and stakeholders via qualitative semi-structured interviews from potential users of the ontology (Bullinger, 2008, pp.237-238).

- Al Debei, reviews both the (Information Systems) Design Science and Ontology Engineering methodological literature. However, by relying on the Ontology Engineering field to inspire his detailed research design he does not identify a single preparation activity stream. Rather, following his summary of the activities suggested by the Ontology Engineering field, he chooses a number of design steps or phases: Planning, Analysis and Design, Development (Implementation), Evaluation and Maintenance (Al-debei, 2010, ch.2 pp.25-66).

  His analysis and design phase is identified as comprising of the sequence of steps: "knowledge acquisition, conceptualization, visualization and formalization". Of these knowledge acquisition is clearly related to preparation which he describes as "the acquisition of the basis knowledge needed to build an ontology". Al Debei's conceptualization step is more difficult to categorize as purely a preparation activity (compared to a build activity): "the structure[ing of] the domain knowledge into a conceptual model". Visualization and formalization are clearly build activities.

  Like Osterwalder and Bullinger, Al Debei then focuses on the methods and techniques to be used, but explicitly suggests these are executed iteratively: the output from each iteration is "enriched" by subsequent iterations. The selected preparation techniques are: library research and literature analysis; qualitative semi-structured interviews to "enrich the ontology […] founded on empirical[…] investigat[ion]"; and case studies which are used "partly to build the ontology [but] principally used for evaluation and practically validating the constructed ontology".

This review of the exemplar organizational ontologys' design of their preparation activities shows there is some implicit and a little explicit acknowledgement of the analytic perspective, but no acknowledgement of the synthetic perspective. Writing

15-20 years earlier than the exemplar authors Gause and Weinberg stated that at that time the deep questions inherent in any process that attempts to know what is desired "are somewhat neglected in the systems development literature" (Gause, 1989, p.xvii)[4].

Based on this, there appears limited methodological and technique advice within the (Information Systems) Design Science and Ontology Engineering fields to explicitly and systematically undertake systemeic design science preparation activities.

Systems Responses

That not much 'best practice' advice on preparation was found in the search of the Design Science and Ontology Engineering literature recalls the motivation to integrate systems thinking into this research design, introduced in chapter 3.

In his comprehensive review of the systems tradition as it applies to management Jackson contains much advice for researchers (and practitioners) on how best to rigorously understand problem and solution domains (M. C. Jackson, 2000). Systems approaches, to varying degrees depending on their world-views (Jackson calls them "sociological paradigms", p.22), all explicitly recognize and provide techniques to attempt to:

- Gather knowledge about problems and desired ideal future state of solutions from a diversity of knowledge sources (tacit and explicit) via observation and interaction.
- Understand the problem and solution domains from multiple world-views.
- Handle potential irreconcilability about the problem and the desired solution at a point in time and / or over time.

[4] This conclusion is further born out by the author's personal practitioner experience in management information systems: the identification and validation of "requirements" remains highly variable and apparently a primary source of the frequent failure to achieving the stated benefits of digital management information systems.

- Discuss the reflexive relationship between the processes to understand problem and solutions domains and the understanding so gained.

Mitigation of Risks from Limitations on Attempts to Know Desires

The above establishes that there are multiple limitations to any systemic design science research preparation: attempting to discover what is desired. This is a source of risk to both the rigour of the research process and the legitimacy and the utility of its outputs (it is a specific example of R2, 3.6.10).

The key mitigation is one identified by design science, ontology engineering and soft systems methodologies: artefacts built on the desires identified during preparation must be validated against different sources of knowledge during an evaluation activity. This enables the triangulation of the original identification of the desires, and confirm the artefact meets them (i.e. does the artefact have high utility).

4.2.1.5 Inputs to Preparation

As noted in the overall research design conceptual framework (Chapter 3), the key input to any design science research, and hence a key determinant to the resultant utility of the designed artefact, are the key theoretical frames (K0).

Unsurprisingly this is confirmed by the review of the literature on design science artefact evaluation (Chapter 6). However, a number of points relevant to evaluation, but applicable activities undertaken in the preparation activity stream are also highlighted and hence are discussed here.

The process of evaluation in design science requires a body of evidence be amassed to justify the utility of the artefacts: the comparator knowledge sources (K1-6) introduced in Chapter 3 and fully described in Chapter 6. These sources of knowledge are used to gather feedback on artefact utility since they are different from the knowledge used to construct the artefact: the key theoretical frames (K0).

How do the key theoretical frames, the inputs to preparation, and the rigour of their use during preparation impact artefact utility?

Citing March and Smith's 1995 recommendations (pp.260-261), Osterwalder (2004a, pp.127-129) suggests that the first level of evaluation is the strength of the researcher's argument highlighting the similarities and differences between previous work, i.e. the key theoretical frames (K0), and the ontology's design (constructs, models, instantiations):

> *A certain form of evaluation is provided by comparing and positioning the ontology to the literature in the field of business models. This is achieved in this dissertation by describing similarities and differences and arguing why the ontology signifies an advance in business model research.* (p.128)

This suggests that the possible level of utility discovered during evaluation is significantly pre-determined during preparation by the manner and rigour with which preparation is undertaken.

Brank, in his 2005 review of ontology evaluation methods from an ontology engineering perspective, concurs. He suggests there are four broad categories of evaluation methods, of which the third aligns with March and Smiths recommendation "comparing the ontology to some [previous and hence] authoritative data source" (Brank, Grobelnik, & Mladenić, 2005).

This was also the approach explicitly taken by Al-Debei. During the initial build of his ontology he "evaluated against the existing body of business model literature and his ontology Design Quality Evaluation Framework" (Al-debei, 2010, p.21).

Ledington and Ledington provide systems thinking advice on identifying the contexts for evaluation; work they suggest is best undertaken during preparation (Ledington & Ledington, 1999). Ledington and Ledington suggest that there must be an interaction between users' expectations of artefact utility (and the sources of those expectations) and their reporting of artefact utility gathered in the comparator knowledge sources, i.e. if users of the artefacts believe the key theoretical frames are well chosen, contain valid knowledge, and are appropriately incorporated into the artefact, this is likely to positively shape their perceptions of artefact utility and hence provide tacit and explicit comparator knowledge that suggests the artefact is highly useful.

This adds further support to rigour being at the root of legitimacy in design science research: attempting to maximize user's positive expectations through thorough rigorous preparation prior to constructing an artefact strongly contributes to the legitimacy of the research output.

Summarizing: the preparation activity stream sets a powerful context for the potential utility of the artefacts through its justification for the process of choosing and the choice of the key theoretical frames.

4.2.1.6 Outputs from Preparation

As noted, the methodological and the exemplar literature makes only general suggestions about the outputs of preparation: "an understanding of the problem and solution domains" required to construct the artefact in light of the research objectives.

The large size and deep complexity of the problem and solution domains makes the choice and presentation of the outputs of preparation non-trivial. As an example: the complexity of the natural science related to sustainability is now so complex that the effort involved to construct a formal ontology for this problem and solution domain and to enable its use through a digital information system is now considered worth while (Kumazawa, Saito, Kozaki, Matsui, & Mizoguchi, 2009).

However, synthesizing across all the design science, ontology engineering and systems thinking literature reviewed, suggests that the outputs from the preparation activity stream are, in the following order:

1. A process to design the research.
2. An overall research design.
3. A detailed design of the prepare research activity stream.

4. An understanding of the problem and solutions domains structured to enable the subsequent creation of the artefact.
5. A detailed design of the build research activity stream.
6. A detailed design of the evaluate research activity stream.
7. A detailed design of the communicate research activity stream.

Outputs 1-3 and 5-6 are all research designs. From the literature the 'best' approaches to creating and communication research designs is well understood:

A. A search for similar research which has been found legitimate is made in the literature.
B. A reflection on these research designs is made in light of the research objectives.
C. This reflection is applied to create the "best" research design for the research project.

These are the now familiar three steps introduced in II-2.

However output 4 is perhaps specific to designed artefacts. It relates to one of Gause and Weinberg's (1989) deep questions: "how can a discovered (legitimate) desire be best described so that it can be best used to build an artefact (reliably, consistently, effectively)?"

Once again searching the literature for best practice advice to respond to this question leads only to generalized advice and / or techniques which are asserted to be useful; both with limited or no supporting evidence.

From a pragmatic perspective this is perhaps hairsplitting with no consequence. That in this research a clear (albeit conceptual) line is attempted between the preparation and build activity streams is perhaps of no practical consequence. On the other hand the very definition of an ideal-seeking purposeful inquiring system (such as this research design), suggests that multiple artefacts may be created from the same problem and solution domain knowledge (aka the states of the system). Hence maximizing the transparency of the path to create the artefact may practically enhance rigour and research output legitimacy.

A resolution is suggested through the use of a concept widely used in all fields of design, albeit without a definition: the design principle[5, 6, 7, 8]. In this research a design principle is defined as:

> A statement of what is desired of, or a requirement for, some aspect of an artefact.

Explicating[9]:

- A Design principle **is**
  - An explicit normative constraint to some aspect of the artefact, yet to be built at the time the statement is made (i.e. ideally, once the artefact exists, upon evaluation, the design principle will be found to be true)
  - Generated using logical techniques: analysis and synthesis; induction, deduction or abduction considering explicit or tacit knowledge of the problem and solution domains.
  - Communicated using an existing human language or an artificial (more formal) language.

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[5] This observation is further born out by the:

- International Conference of Design Principles and Practices does not offer a working definition for the term on its website (International Conference on Design Principles and Practices, 2011)
- Author's practitioner experience in management information systems: the methods and techniques for elaborating and communicating requirements (aka desires) are numerous and without empirical or other support. Further these methods and techniques are often confused with those for describing a design of an artefact based on those requirements. Gause and Weinberg's book recommends and differentiates itself by its unusual and explicit discussion of requirements before design!

[6] The work on pattern languages, originating in the field of architecture (Alexander, 1977) and subsequently widely used in object-oriented development of digital information systems, is clearly related to design principles. Patterns could be considered generalized design principles, based on the definition below.

[7] One of the few exceptions, using the terminology "construction principles" and "design rules" rather than "design principles" is the work of systemic design science organizational researchers Romme and Endenburg (Romme & Endenburg, 2006).

[8] Two overall design principles (ODP1 and 2) are defined in Chapter 3. However, earlier the term design principle was left undefined.

[9] Based on a synthesis of all the literature on design science, ontology engineering and systems thinking consulted and the author's personal practitioner experience in management information systems design over nearly 25 years.

- Design principles **may** be satisficed by:
  - An artefact (i.e. the feedback on the veracity of the design principles and hence the utility of the artefact is determined by the evaluation of the artefact).
  - Multiple different artefacts (i.e. each of the multiple artefacts may have the same level of utility even if there is a change in the context, such as: when it is built, a change in: person building the artefact, or some aspect of the environment in which the artefact is to be built or used. The choice of the best way of satisficing the design principles in any specific context is the abductive process of design.)
- Design principles are **not**:
  - The artefact itself nor its description.
  - Necessarily all satisficed at the same level of utility in a single artefact (i.e. some design principles may partially or completely contradict one another).
- Collectively, a set of design principles attempt to be maximally internally consistent / coherent given the overall research objective.

4.2.1.7 Methods and Techniques for Preparation

The review of the research designs of the exemplar business ontologies suggests that any research method and technique may be used during preparation. All three exemplar business ontologies use library research and literature analysis, two some form of semi-structured interviews and one case studies.

The detailed design for the preparation activity stream of this research uses library research and literature analysis (see 4.2.2 and 4.2.3 below for justification for and details of this choice). Hence the search for best practice advice for methods and techniques for preparation is restricted to these technqiues.

Introducing their 2011 work “Doing Your Literature Review: Traditional and Systematic Techniques” Jesson, Matheson and Lacy state that since the late 1980’s “the methodology of the literature review has advanced at a remarkable pace" to include both the "traditional" and the "more questioning and critical" "systematic review methodology" (Jesson, 2011, p.1).

That the literature review is a method compatible with the objectives of rigorously deriving design principles from existing knowledge in systemic design science research is confirmed by Jesson et. al.'s statement that "the first step in [any] research is to assess what is already known".

However Jesson et. al. go on to observe the amount of comprehensive best practice advice available to researchers creating their literature review research designs has been limited to a single 1998 text until "about five years ago when some new texts [concerning] the systematic [literature] review were published". Further that until their 2011 work, there was "still no text covering both the traditional literature review and the systemic review" techniques. This was felt to be important because "researchers have to be able to undertake a traditional literature review in preparation to do a systematic review" (p.3).

Summarizing Jesson et. al. (p.15):

- A traditional literature review selects literature to be included based on a contribution to the research purpose identified by the scholar. This provides the scope to be reflective and provide insight, although this may be at the expense of bias and transparency.
- A systemic literature review takes a rational / standardized approach to selecting and undertaken the review which enhances objectivity and transparency.
- In either case a research question for the literature review is considered mandatory (p.18).

More specifically what does the literature from design science, ontology engineering and systems thinking say are best practices for undertaking literature reviews and applying the results to the creation of artefacts? Specifically how should the literature review be best undertaken to ensure the greatest rigour in the creation of the seven outputs of the preparation activity stream and legitimacy of their respective outputs?

From the search undertaken it appears the literature is silent at this level of detail.

4.2.2 Choosing the Approach for Preparation

The review and summary of the literature on preparation from the design science, ontology engineering and soft systems methodology fields was presented in the previous sub-section. This included the definition and purpose of preparation, along with the recommended process for rigorsly undertaking preparation, the outputs required from preparation, the methods and techniques that may be used, and the impact of preparation rigour on artefact utility.

This sub-section presents a reflection on this literature in light of the research objectives; the following sub-section presents the results of applying this reflection to make choices to create the preparation activity stream detailed design.

4.2.2.1 The Current State of the Art

The literature suggests that understanding how best to rigorously prepare for the creation of artefacts is a relatively new field of research. The advice and guidance on how to construct a high quality preparation research design that is rigorous, and hence maximizes the likelihood of research legitimacy, is at best incomplete.

For preparation research designers the literature has a troubling lack of specificity in:

1. How to best understand the problem and solution domains, i.e. the identification of desires (4.2.1.4)?
2. How can a discovered (legitimate) desire be best described so that it can be best used to build an artefact (reliably, consistently, effectively) (4.2.1.6)?
3. How the literature review can be best used to identify legitimate desires from key theoretical frames given a specific research objective (4.2.1.7)?

However, despite these concerns, recently the exemplar researchers have all managed to construct and justify their preparation research designs. The strong impression one receives is that these researchers have abducted their preparation research designs from the literature based on their understanding of the connection between preparation rigour, the resultant utility of their artefacts and hence the legitimacy of their research.

4.2.2.2 Preparation Research Design Goals

Introduction

Though the exemplar researchers successfully defended their research designs, there is room for improvement. A possible contribution of this research is to improve research output quality by attempting to be more explicit in the process that creates the preparation stage of the research, i.e. describe the goals for the research design, the possible choices of research design, the selected choice and the basis for these choices[10].

Hence, the goal of this heading is, based on the literature, to be as explicit as possible about the process of designing the preparation activity stream.

Detailed Goals

The literature on the design of the preparation stage makes it clear that typical risks to research output validity which apply when designing any kind of systemic design science (and indeed qualitative research in general) also apply to the preparation stage of design science research.

Applying the earlier analysis of these general points (3.5.4): it is important to identify research design goals that aim to mitigate these risks. Specifically it is a goal of this preparation research design that there be:

- Explicit objective setting (3.5.4.2)
- Use of iteration (3.5.4.3)
- Explicit setting of boundaries (3.5.4.4)
- Explicit identification of world-views (3.5.4.5)

[10] i.e. the search, reflect, apply steps set out at the start of this part.

Whose Desires Are Identified?

Preparation is not concerned with identifying the researcher's desires for this research; these are already captured in the research context, motivation and objectives (Part I, refined in 3.6.6).

Preparation is 'simply' concerned with identifying the research designs, the required key theoretical frames and the SSBMO detailed design principles within these identified research objectives (i.e. the researcher's desires) [11].

Design Goals for Research Designs

These were described at the start of this part: RO0, maximizing rigour to increase the legitimacy of the research outputs based on the process described in II-1 and II-2 and justified in the overall research design (Chapter 3).

Design Goals for Creation of the Detailed Design Principles

Synthesizing from the literature above, the overall goal for the creation of the detailed design principles is do-ability and conceptual clarity.

In this, it seems advisable to reject what appears to be the conceptually muddy approach taken by two of the exemplar organizational ontologies. Bullinger and Al-Debei considered their key theoretical frames to include both the output from descriptive science ***and*** tacit knowledge from persons identified as experts gathered via semi-structured interviews. The muddying comes from the fact that the comparator knowledge gathered to evaluate the utility of the ontologies was also obtained from experts via semi-structured interviews. While these researchers were

[11] This applies to the creation of an ontology of business models. As a contrast, in the context of creating a business model (an instantiation of the ontology) the desires comes from the person who convenes the design process and those actors deemed legitimate by the convener. This suggests the convener and the other legitimate actors prepare for the business model design process by applying the same advice above (4.2.1). However, in this case the desires will not be from literature (as it is for the ontology), but from the convener and other legitimate actors: e.g. General questions such as who is a legitimate source of desires for this business and why (aka Stakeholders)? And then more specific questions such as: How does each stakeholder know what they desire of this business? Such preparation steps are key to any method to design a business model. As noted in 2.6 they are out of the scope of this research; but as per Figure 3-17 the research design for this research and such a business model design method are highly related.

careful not to interview the same persons to obtain key theoretical frames and comparator knowledge, the interviewees were in similar industries, positions, and world-views. This seems to significantly increase the possibility, discussed in 3.2.3.4, that all that is being demonstrated during evaluation is the is the internal consistency of the solution and not it's utility in solving the problem

Hence, in this research, following Osterwalder's lead the:

- Detailed design principles are created from the analysis and synthesis via induction, deduction and abduction of key theoretical frames (K0, K0-PF, K0-SS) as described ***only*** by the descriptive science literature considered relevant given the research objectives.
- Comparator knowledge (K1…6) is gathered from the analysis and synthesis via induction and deduction of practitioner knowledge. The relevant sources of comparator knowledge include explicit and tacit knowledge from a diverse set of businesses and persons who hold a range of world-views (see Chapter 6, evaluation research design for details of how this is accomplished).

This design goal creates considerable conceptual clarity between the key theoretical frames (K0, K0-PF, K0-SS) used to create the detailed design principles and hence the SSBMO, and the comparator knowledge (K1…6) gathered to evaluate the SSBMO. This strong contrast between the sources of the knowledge:

1. Enhances the legitimacy of the SSBMO by only using explicit credentialed descriptive science knowledge in its creation.
2. Increase the possibility for obtaining more feedback on, and hence room for improving, the SSBMO, by only using explicit and tacit knowledge from practitioners in its evaluation.
3. Reduces the risk created by the limitations on attempts to know desires (identified in 4.2.1.4), by increasing possibility for contrasts in desires to be identified

between those implicit in the research objectives and the identified key theoretical frames and those expressed in the comparator knowledge.

4.2.2.3 Constraints on the Choices of Preparation Research Design

There are always practical constraints when making the choices between possible preparation research designs. As part of being explicit about the research design process for this research, these constraints are:

1. Time to identify relevant key theoretical frames
2. Availability of literature believed relevant
3. Time to search literature, create the research designs and subsequently execute them
4. Time to search literature; create the detailed design principles and subsequently the SSBMO.
5. Effort available within available time

Clearly any constraints will have an impact on the rigorousness and quality of the research designs and the SSBMO detailed design principles. However, within the scope of an exploratory thesis, which is not claiming a high degree of generalizability, and in comparison with examples from the exemplar literature, these compromises are not problematic. They simply open avenues for further research (Chapter 11).

4.2.3 Preparation Detailed Research Design

This section applies the reflection of the literature searched above. It presents an overview of the research design created to prepare for the creation of the SSBMO developed from the key theoretical frames given the research objective and the preparation design goals (4.2.2.2).

The seven preparation activity groups within the preparation activity stream are described. A summary of the preparation activity stream is provided at the end of this Part (Table II-1).

4.2.3.1 Activity Groups within Preparation

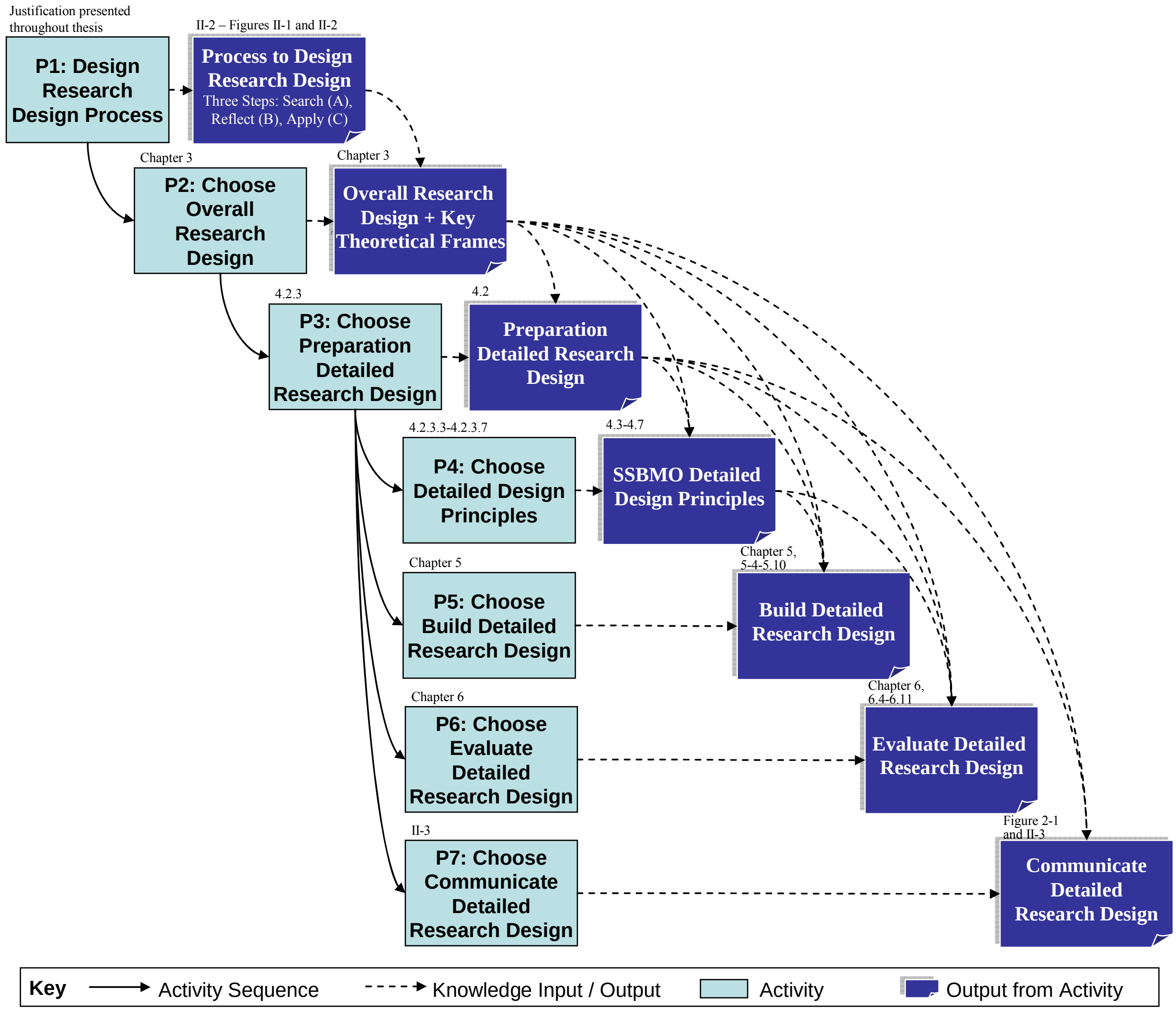

Figure 4-1: Preparation Activity Groups and Relationships of their Outputs

As shown in Figure 4-1 the preparation activity stream consists of seven activity groups, as follows:

P1. **Choose the process to design the research design**. This includes the identification of the three steps show in Figure II-1 and their iterative use – Figure II-2. Described at the start of this Part (II-2).

P2. Use the process created in P1 to **choose the overall research design**. This work includes, based on the research objectives, a review of the literature on the subject matter of this research (strong sustainability and business models) leading to the **identification of the relevant key theoretical frames**. Described in Chapter 3.

P3. Within the context of the overall research design created in P2, **choose the detailed research design for the preparation activity stream**. Described in the first segment of this chapter (4.2.1-4.2.2).

P4. Use the process created in P3 to **choose the detailed design principles for the SSBMO**. Described in the second segment of this chapter, below.

P5. Within the context of the overall research design created in the P2, the preparation detailed design created in P3, and the detailed design principles created in P4 to **choose the detailed research design for the build activity stream**. Described in Chapter 5.

P6. Within the context of the overall research design created in the P2, the preparation detailed design created in P3, and the detailed design principles created in P4 to **choose the detailed research design for the evaluate activity stream**. Described in Chapter 6.

P7. Within the context of the overall research design created in the P2 and the preparation detailed design created in the P3, **choose the communications activity stream research design**. This work includes a review on the literature about how to communicate this research. Described in Figure 2-1 and the start of this part, II-3.

Note that the sequence of execution of tasks within the preparation activity groups is not linear; rather iteration and recursion were involved that include tasks in different activity groups and indeed in other activity streams[12].

[12]As mentioned at the start of this part: In this thesis, inherent complexity is (hopefully) made comprehendible by sequencing the description of the research by increasing levels of details of its results, and not by topic nor in the conceptual or actual sequence of the tasks that produced the results. This (hopefully) enhances

4.2.3.2 Selected Methods and Techniques

Table 4-1 presents the type of literature review for each preparation activity group (and for completeness includes the chapter in which the output of that review is presented).

Nº	Preparation Activity Group	Type of Literature Review Used*	Chapter Describing Review and Results
P1.	Choose process to design this research	Traditional	Start of part II (II-2)
P2.	Choose overall research design	Traditional	Chapter 3
P3.	Choose preparation detailed research design	Traditional	Chapter 4 (this chapter, 4.2)
P4.	Choose design principles for the SSBMO	Traditional and Systematic	Chapter 4 (this chapter, 4.3-4.7)
P5	Choose build detailed research design	Traditional	Chapter 5
P6	Choose evaluation detailed research design	Systematic	Chapter 6
P7	Choose communications detailed research design and output	Traditional	Start of part II (II-3)

* As defined by Jesson et. al. (4.2.1.7)

Table 4-1: Types of Literature Review Used in the Preparation Activity Stream

comprehendability by grouping presentation of results at similar levels of detail and the manner in which these results were obtained.

In this case, from a research execution sequence perspective, activity group P3 produces the detailed research design for undertaking preparation activity groups P1 and P2, and P1 and P2 create the context for aspects of all preparation activity groups (P1-P7).

Within the context created by the description of the overall process of designing this research (output of P1, described at start of part II) and the overall research design (output of P2 described in Chapter 3) it is hoped that the presentation of the preparation activity stream detailed research design at this point is comprehensible: this despite the necessary forward and backward references to the results of executing the various preparation stream activity groups.

4.2.4 Preparation Detailed Research Design: Activity Group P4

4.2.4.1 Introduction

As shown in Figure 4-1, what that remains for this chapter is to:

- Describe, in this sub-section (4.2.4), the detailed research design for the traditional and systematic literature review used to identify the detailed design principles (i.e. a portion of the results from P3 that form the research design of P4). This description includes how the techniques to ensure research rigour identified in 3.5.3 were applied in the detailed research design of P4.
- Describe, in the second segment of this chapter (4.3-4.9), the outputs of these reviews and present the SSBMO detailed design principles (i.e. the results of executing P4).

4.2.4.2 Preparation Activity Group P4: Research Question

Following the advice of Jesson et. al. (4.2.1.7) any literature review needs to have a research question. The research question for activity group P4, that guides the literature reviews to identify the SSBMO detailed design principles (introduced in 3.5.3.4), is:

RQa: How can strong sustainability emerge as an outcome of an organization understood as a multi-minded ideal-seeking purposeful system (analysis), and what systems contain / provide context for an organization so understood (synthesis)?

Within this, to adhere to the established overall design principles (ODP1 and 2), in order to have high utility

The SSBMO and the SSBMC it powers must be able to describe business models conceived from world-views anywhere on a continuum from profit-first (K0-PF) to strongly sustainable (K0-SS).

Clarifying, the literature reviews undertaken in preparation activity group P4 answer the following questions:

> Within the identified Key Theoretical Frames what is known about business models from a range of world-views (K0, K0-PF, K0-SS)?
>
> What detailed design principles (DDP1..n) for the construction of the SSBMO can be derived from this knowledge while adhering to the overall ontology design principles (ODP1 and 2)?

4.2.4.3 Preparation Activity Group P4: Process

Figure 4-2 shows an overview of preparation activity group P4 in the context of the overall research design (prepare [P], build [D], evaluate [E]). Also shown are the input to and output of results relevant to activity group P4 from:

- Tasks within of activity group P4
- Each of the other activity streams

Starting in the lower right corner of Figure 4-2 and moving clockwise:

- Descriptive science theorizes, through disciplinary lenses, about business models, based on operating firms and their contexts, from a range of world-views from neo-classical to ecological (Table 3-9).
- Following the advice of Jesson et. al. (4.2.1.7) activity group P4, explores the problem and solution domains (as described in the identified key theoretical frames) using a traditional literature and then a structured literature review.

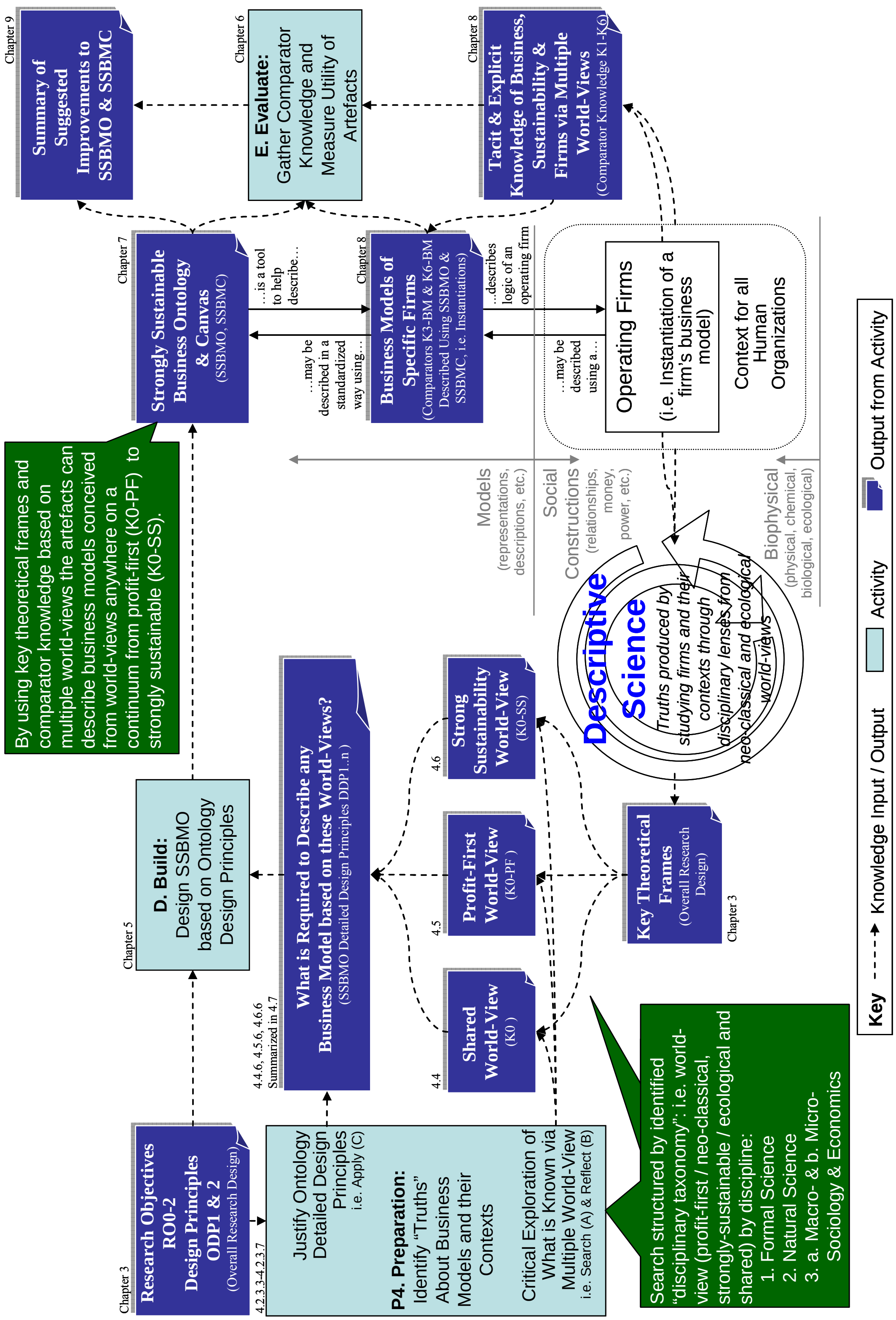

Figure 4-2: Preparation Activity Group P4 Context and Overview

This is shown on the left of Figure 4-2: preparation activity group P4 uses the research objectives (R0, 1 and 2) and overall design principles (ODP1 & 2) (top left) to:

- **P4-1**: Firstly, critically explore the key theoretical frames identifying a “disciplinary taxonomy” using a traditional literature review

  As shown at the bottom of the centre left box in Figure 4-2, this is the first use in activity group P4 of the first two of the now familiar three step process (search, reflect)

  The disciplinary taxonomy structures the world-views and disciplines: profit-first / neo-classical, strongly-sustainable / ecological and shared vs. formal science, natural science, macro- & micro- sociology & economics (introduced in Table 3-9, and used to structure 3.5.3.1-3.5.3.4). The disciplinary taxonomy is formally described in 4.3.

- **P4-2**: Secondly, critically explore the key theoretical frames using a structured literature review. The structure for this review is provided by the identified disciplinary taxonomy.

  As shown in the bottom of the centre left box in Figure 4-2, this is second use of the first two of the three steps in activity group P4. The results of this structured literature review is described in 4.4-4.6.

- **P4-3**: Thirdly, using the third of the three step process, apply the results of these literature reviews using analysis and synthesis, via induction, deduction and abduction to create the SSBMO Detailed Design Principles (DDP1..n). The detailed design principles:

  - Answer the research questions for preparation activity group P4 (4.2.4.2).
  - Document the ‘desires’ from the key theoretical frames, i.e. what does descriptive science suggest is required to describe any business model based

on the continuum of world-views: profit first (K0-PF) to strongly sustainable (K0-SS), as well as shared elements (K0). These are described in 4.4.6 (K0-Shared), 4.5.6 (K0-Profit First), 4.6.6 (K0-Strongly Sustainable) and summarized in 4.7.

- As shown along the top of Figure 4-2, the build activity stream (top centre, described in Chapter 5) then uses the research objectives (R0,1 and 2), the overall design principles (OSD1 and 2) (left) and the detailed design principles (DDP1..n) (below) to design the SSBMO and the SSBMC it powers (right, described in Chapter 7).
- As shown on the lower right of Figure 4-2, the evaluate activity stream (described in Chapter 6) then gathers comparator knowledge: tacit & explicit knowledge of business, sustainability & firms via practitioners who hold multiple world-views from profit first to strong sustainability (K1-K6) (lower right).
- Some of this comparator knowledge, about specific firms, is expressed as business models of those firms described using the SSBMO and SSBMC (K3-BM and K6-BM), i.e. instantiations of the SSBMO and SSBMC. The results of the process of gathering and the comparator knowledge gathered, is described in Chapter 8.
- As shown on the upper right of Figure 4-2, the evaluate activity stream (described in Chapter 6) then generates feedback on the utility of the SSBMO through an analysis and synthesis of the comparator knowledge (Chapter 8). This leads a summary of improvements that could be made to the SSBMO and the SSBMC that evaluation suggests would improve their utility (upper right) (described in Chapter 9).

4.2.4.4 Preparation Activity Group P4: Outputs

As shown Figure 4-2 preparation activity group P4 produces:

1. A summary of the problem and solution domains structured by a disciplinary taxonomy from the key theoretical frames

2. Detailed design principles for the SSBMO and the SSBMC it powers: what does descriptive science suggest is required to describe any business model based on the continuum of world-views: profit first (K0-PF) to strongly sustainable (K0-SS), as well as and shared elements (K0).

Together these outputs answer the research questions for preparation activity group P4 (4.2.4.2).

Detailed Design Principles for SSBMO

Based on the definition of a design principle (4.2.1.6) and the design goals for the detailed design principles (4.2.2.2):

Each Detailed Design Principle (DDP1..n):

- Is a statement of what is desired of, or a requirement for, some aspect of the SSBMO.
- Contributes to one or both of the Overall Design Principles (ODP1 & 2). i.e. Concepts that are required to measure or describe the design of a profit-first and/or strongly sustainable business model based on the literature.
- Is a normative constraint on the design of the SSBMO artefact.
- Is generated from the literature via logical techniques
- Is described using the English Language

4.3 Results of Preparation Activity Group P4

4.3.1 Introduction

The second segment of this chapter describes the results of executing preparation activity group P4 to choose the Detailed Design Principles for the SSBMO (DDP1..n).

The results of the other activity groups within the preparation activity stream are described elsewhere in this thesis (see 4.2.3.1 and Table 4-1).

Activity group P4 answers the questions identified in 4.2.4.2 using the three steps P4-1..3 described in 4.2.4.3.

4.3.2 Results of Traditional Literature Review

4.3.2.1 Disciplinary Taxonomy – Development

During course work and other reading extensive notes (approx. 260 letter pages) were taken from the course materials and literature to attempt to identify the key theoretical frames and portions of potential patterns of business model designs that might contribute to strong sustainability outcomes[13]. Collectively these notes might be said to be attempts to explain and describe the antecedents of strongly sustainable organizational outcomes.

From these notes a first attempt at abducting a disciplinary taxonomy was developed. This structure is based on the common conception of strong sustainability requiring holistic consideration of the objects and processes of (1) the bio-physical and (2) the social (including the subsumed economic). Further, since organizations use and sometimes create technical objects (both real and virtual) from the bio-physical and social realms it seems (3) the technical is also of interest (i.e. the objects and the processes which create them)[14].

Of the possible differences and unions between these three sets, the literature was structured into a taxonomy: the bio-physical, the bio-physical-technical, the socio-physical, the social (including the socio-economic) and socio-technical.

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[13] Only portions of patterns of sustainability business model designs could be found, hence WH1.

[14] This was inspired by conceptions of the (socio-) technical developed by Trist and others (Trist, 1981a).

Patterns Potentially Leading to Strong Sustainability Outcomes of Firms

- **Bio-physical-technical**: *Abundance within Planetary Limits*
  - (Goldratt, 1997; Lawn, 2001)
  - (McDonough & Braungart, 2002; Rockström & et. al., 2009)
  - (Rockström, 2009)
  - **Bio-physical**: *Biomimicry* (Benyus, 2002)
    - *Green chemistry* (Anastas, 1998)
  - **Bio-physical-technical**: *Effectiveness* (Pauli, 2010; Weizsäcker, 1997; Weizsäcker, 2009)
- **Socio-Physical**: *Locality*(Lovins, Lovins, & Hawken, 1999; Ostrom, 2008)
- **Social, Socio-Economic and Social-Technical**: *Systems and complexity*
  - *Continuous improvement*
    - *Learning organizations* (Senge et al., 1999) (Sterman, Repenning, & Senge, 2000)
    - *Quality management* (Aguayo, 1990; Deming, 1986)
  - *Business* (Gabor, 2010; Gharajedaghi, 2006; Sterman, 2000) (Osterwalder, 2004a; Osterwalder & Pigneur, 2009; Trist, 1981a)
  - *Design* (T. Brown, 2009; Lockwood, 2010; Stasinopoulos, Smith, Hargroves, & Desha, 2009)

Figure 4-3: Taxonomy of Patterns Potentially Leading to Strong Sustainability Outcomes of Firms

The taxonomy of patterns shown in Figure 4-3 structured further searches of the literature that identified the disciplinary taxonomy.

4.3.2.2 Disciplinary Taxonomy – Results

A summary of the disciplinary taxonomy was provided in Table 3-9, and used to structure the presentation of the literature concerning organizations':

- Context (in response to Challenge 2-1a) (3.5.3.1)
- Parts (in response to Challenge 2-1b) (3.5.3.2)

In turn, this provided the justification for the final identification of the key theoretical frames (3.5.3.3-3.5.3.4) and completed the traditional literature review related to the research objectives (P4-1).

	World-view **Disciplinary Lens**	**Shared** (K0)	**Profit-First** (K0-PF)	**Strongly Sustainable** (K0-SS)
Increasing levels of detail in respect to unit of analysis: the business model	Formal Science ● Design ● Information ● Systems	World-view Unimportant	Not Applicable	Not Applicable
	Natural Science ● Physics ● Chemistry ● Biology ● Ecology ● Psycho and physio-logical	World-view Unimportant	Neo-classical	Ecological
	Macro- ● Social Science ● Economics	World-view Unimportant	Neo-classical	Ecological
	Micro- ● Social Science ● Economics Includes organization and management knowledge related to: ● Innovation ● Strategy ● Operations (OM) ● Information Systems (MIS)	World-view Unimportant	Neo-classical	Ecological
	Systematic Literature Review Results Presented in Section ● Resultant Detailed Design Principles Presented in Section	4.4 4.4.6	4.5 4.5.6	4.6 4.6.6

Table 4-2: Disciplinary Taxonomy for Systematic Literature Review of Key Theoretical Frames Relevant to the Strongly Sustainable Business Model Ontology

Table 4-2 fully describes the disciplinary taxonomy resulting from preparation activity group P4-1. This disciplinary taxonomy structures the systematic literature review of the key theoretical frames related to the research objectives (P4-2), enabling the identification of the SSBMO Detailed Design Principles (DDP1..n) (P4-3).

Only one comment needs to be made relative to Table 4-2: the definition of the world-views. The literature is judged to be from a:

- **Profit-first world-view (K0-PF)** if it is held as valid by scholars who take the neo-classical or weakly sustainable world-view.
- **Strongly sustainable world view (K0-SS)** if it is held as valid by scholars who take the ecological, systems or strongly sustainable world-view.
- **Shared world-view (K0)** if it is held as equally valid by all scholars whose works were reviewed.

The availability (albeit incomplete) of the works reviewed (3.5.3), as well as the relative ease with which they could be structured into this taxonomy lends support to WH1.

Further the apparent lack of a clear intersection of the literature that takes an "Ecological Conception of Organizations, Their Contexts and Parts" (3.5.3.1, 3.5.3.2) and the literature which takes a "Neo-Classical Conception of Organizations and Their Parts" lends weight to WH2 (3.5.3.2). In contrast the clear intersection of the strong sustainability and industrial ecology literature lends support to WH3.

4.3.2.3 List of Searches

In addition to the disciplinary taxonomy, the traditional literature review also identified key word searches to be conducted during the systematic literature review. These includes combinations of:

Business (Firm, Organization)
Business Model
Ontology (Tools, Canvas)
Sustainable (Sustainability, Strongly Sustainable, Strong Sustainability, Weak Sustainability)
Resilience
Strategy, Innovation, Entrepreneurship, Design
Emergence
Design (Science, Thinking, Failure, Performance, Research, Redesign): Prepare, Build, Evaluate, Communicate
Systems (Thinking)
Patterns
Model
Industrial Ecology (Industrial Symbiosis, Biomimicry, Eco-system services and Bio-physical stocks)
Service systems (Servicisation)
Needs (Wants, Values Valued, Valuation, Sufficiency, Efficiency, Effectiveness, Satisfice, Bounded Rationality, Substitution)
Stakeholders (Actors, Roles, Inter-relationships),
Power and Legitimacy
Business Process Analysis and Design (History, Maturity of Design, Maturity of Design Process, Changing, Activity Theory, Network Theory, Organization Theory, Co-ordination Theory, Adaptive Management, Measurement, Management of, Viable System of, Information Systems)
Measurement (Measure, Indicator)
Ecology (Ecosystem, Organizational, Managerial, Collaborative)
Social Innovation
Theory
Epistemology (Research Methods and Techniques)
Criticism
Pragmatism
History (of Need for Organizations / Purpose of Business, of Progress, of Growth)

These searches were conducted in the academic and practitioner literature available via library resources and the internet (primarily Google Scholar and Google Web).

In addition to academic and practitioner monographs, chapters in books, single articles in practitioner journals and peer reviewed journals, the following specific sources were found relevant:

- Academy of Management Review special issue on Ecologically Sustainable Organizations – October 1995 (v20, issue 4)

- Business Strategy and the Environment special issue on Sustainability and Design – September-October 2005 (v14, issue 5) (Dobers & Strannegård, 2005)
- Organization Science special issue on Design – March-April 2006 (v17, issue 2) (Dunbar & Starbuck, 2006)
- 4th International Conference on Design Science Research in Information Systems and Technology (DESRIST 2009) – May 7-8, 2009 Malven Pennsylvania
- Organizational Studies special issue on Design – March 2008 (v29, issue 3)
- European Journal of Information Systems special issue on Design Science Research – October 2008 (v17, issue 5) (Baskerville, 2008)
- Management Information Systems Quarterly special issue on Design – December 2008 (v32, issue 4)
- Long Range Planning special issue on Business Models – April-May 2010 (v43, issue 2-3) (Baden-Fuller, Demil, Lecoq, & MacMillan, 2010)
- Information Systems and e-Business Management special issue on Design Science – March 2011 (v19, issue 1) (Gregor & Hevner, 2011)
- Journal of Design Research
- International Journal of Design Principles and Practices
- Journal of Industrial Ecology
- Journal of Cleaner Production

Finally, the notes that helped abduct a taxonomy of patterns potentially leading to strong sustainability outcomes of firms (Figure 4-3), also identified specific topics that suggested further searches during the systematic literature review. A list of the relevant academic theories found was presented in 3.5.3. In addition the following ideas, topics and organizations were also identified:

- "The next industrial revolution" (McDonough & Braungart, 1998)
- "The new economy" (Korten, 2009)
- "Blue economy" (Pauli, 2010)
- "Natural capitalism" (and variants) (Hawken, 2010, first published 1993; Lovins et al., 1999; Porritt, 2007)

- “Cradle to Cradle” (Closed-Loop, Abundance within Limits) (McDonough & Braungart, 2002)
- Quality Management (Product Manufacturing and Service Delivery) (Aguayo, 1990; Deming, 1986)
- “Triple Bottom Line” (GRI – Global Reporting Initiative) (Norman & Maconald, 2004; Willard, 2012)
- Consumerism and Anti-Consumerism (Beder, 2004)
- Eco-system services, bio-physical stocks and human organizations (Boulter, 2011; Boumans et al., 2002; Hanson, Ranganathan, Iceland, & Finisdore, 2008; Hanson, Ranganathan, Iceland, & Finisdore, 2012; Marcus, Kurucz, & Colbert, 2010; Wilson & Howarth, 2002)
- Geographic and Community Locality and Scale (Bamberg, 2006)
- Energy, Emergy, Exergy, Work, Entropy, Thermodyanmics – 2nd Law (M. T. Brown, 2011; Georgescu-Roegen, 1975; J. J. Kay, 2000; Minkel, 2002; E. D. Schneider & Sagan, 2006; Sorrell, 2010)
- Design for biomimicry, eco-efficency, eco-effectiveness, the environment, reuse, sustainability etc. (Lovins, 2011; Shedroff & Lovins, 2009; Stasinopoulos et al., 2009; Weizsäcker, 1997; Weizsäcker, 2009)
- Life Cycle Analysis (LCA) (Rio, Reyes, & Roucoules, 2011)
- Health and Safety (Barling, Kelloway, & Iverson, 2003; OSHA, 2005; Pagell & Gobeli, 2009; WSIB, 2001)
- “Benefit Corporations” (B Lab, B Corp, MaRS Discovery District Certified B Corporation Hub, GIIRS - Global Impact Investment Reporting System, IRIS - Impact Reporting and Investment Standards)
- “Global Initiative for Sustainable Ratings” (GISR)
- “The Natural Step” (TNS) (Broman, Holmberg, & Robèrt, 2000; Eriksson & Robèrt, 1991; Robèrt, 2002; Robèrt et al., 2002)
- “Business Alliance for Local Living Economies” (BALLE) (Shuman, 2005; Shuman, 2009)
- “Transition Towns” (Hopkins, 2008)

- “International Society of Sustainability Professionals” (ISSP)
- “Green Enterprise Toronto” (GET)
- “Partners in Project Green” (PPG) (Canada’s largest eco-industrial zone Eco-Industrial Solutions Ltd., 2008)
- “Toronto Sustainability Speakers Series” (TSSS) (A business arising from a York University Faculty of Environmental Studies Masters Major Research Paper)
- “Sustainability Learning Centre” (SLC) (A business arising from a York University Faculty of Environmental Studies Masters Major Research Paper)
- Bioinspired Design (Zygote Quarterly)
- “The Sustainability Advantage” (Willard, 2012)
- “School for Social Entrepreneurship” (and its newly opened Ontario branch, SSE-O)
- “Ontario College of Art and Design University” (OCADU) Faculty of Design Masters in Design: Strategic Foresight and Innovation (MDes SFI) and Strategic Innovation Lab (sLab)
- “Unfinished Business Speaker Series” (OCADU Faculty of Design)
- “Forestry Stewardship Council” (FSC) (Conroy, 2007, ch.4)
- “Marine Stewardship Council” (MSC) (Conroy, 2007, ch. 9 pp.212-218)
- “Local Food Plus” (LFP – a Food System Change NGO)
- “The Equator Principle” (Banking & Stewardship) (Conroy, 2007, ch.6)
- “Fair Trade” (Conroy, 2007, ch.5)
- “Tourism Stewardship Council” (Conroy, 2007, ch. 7)
- International Standards related to Continuous Improvement (ISO9000), Environment (ISO14000), Society (ISO26000) and Energy (ISO50000) (Hersey, 1998; ISO, 2011)

4.3.3 Comment on State of Knowledge of Problem and Solution Domains

Some scholars have observed that the generation of humans currently alive is the first who both sufficiently understand the context of organizations (economic, social and biophysical) and who have sufficient systems based scientific, social and historical knowledge to attempt to proactively create outcomes which may be sustained (Tainter, 2003). This, they observe, is due our ability to apply our new found knowledge in:

- Systemic problem solving,
- Predicting the (previously unforeseen) consequences of our solutions, and
- Monitoring the impact on eco-systems of the actions we take.

It is only very recently that key elements of knowledge from both the neo-classical and ecological stances has been created; without this new knowledge this first attempt to derive strongly sustainable business model ontology detailed design principles would not be possible.

As noted in 3.5.3 the majority of scholarship related to micro-sociology and micro-economics (organization and management) takes a neo-classical stance, i.e. it aligns with the key theoretical frame K0-PF. As a result it is no surprise that works exist, such as the exemplar organizational ontologies, that use the design science epistemology to create and evaluate artefacts based on many of the search terms introduced above (4.3.2.3) (from the neo-classical stance).

As also noted in 3.5.3, this is not the case for ecological micro-sociology and micro-economics: no artefacts created using the design science paradigm were found that integrate the search terms introduced above (4.3.2.3) (from the ecological stance). The organizational perspective of the strongly sustainable world-view is not well known or well researched at this time.

The practical implication of this for the systematic literature review is that different types of works are considered from the neo-classical (K0-PF) and ecological stances (K0-SS). Since organizational ontologies, including a business model ontology already exist, and that these ontologies were created and evaluated using a rigorous application of the design science epistemology, there appears little point in rehashing the many primary sources used in identifying their (detailed) design principles. Instead in the profit-first review of the literature these artefacts may be considered directly.

Of course it is important in this review to understanding these neo-classical artefacts in order to identify:

- Relevant definitions which contrast to the definitions provided by the ecological stance,
- Their detailed design principles, and
- Conceptual errors or gaps which have come to light since the creation of these works.

In contrast, for the strongly sustainable world-view, as a result of the lack of exemplars, the literature considered needs to identify:

- Relevant definitions which contrast to the definitions provided by the neo-classical stance,
- Strongly sustainable organization concepts and their interrelations, and
- Areas where there is insufficient or conflicting knowledge of the problem and solution domains to identify detailed design principles.

4.3.4 Introducing Results of Systematic Literature Review

The research question used to focus the searches listed above and subsequently to identify the SSBMO detailed design principles (introduced in 3.5.3.4), is:

> RQa: How can strong sustainability emerge as an outcome of an organization understood as a multi-minded ideal-seeking purposeful system (analysis), and what systems contain / provide context for an organization so understood (synthesis)?

Within this, to adhere to the established overall design principles (ODP1 and 2), in order to have high utility:

> The SSBMO and the SSBMC it powers must be able to describe business models conceived from world-views anywhere on a continuum from profit-first (K0-PF) to strongly sustainable (K0-SS).

Clarifying, the systematic literature review is structured using the disciplinary taxonomy (Table 4-2), to answer the following questions, **first**:

> Within the identified Key Theoretical Frames what is known about business models from a range of world-views?

The response to this question is presented by world-view: K0-Shared (4.4), K0-Profit First (4.5), K0-Strongly Sustainable (4.6); and within each world-view by topics relevant to the research objective structured by the disciplinary taxonomy:

- **Formal science**. This includes the respective understanding of:
  - The utility of models, modelling and modelling formalisms.
- **Natural science**. This includes the respective understanding of:
  - Sustainability and flourishing.
  - Human world-views.
  - Human and non-human needs and satisfiers.
- Neo-classical (for K0-PF) or strongly sustainable (K0-SS) **macro-sociology and economics**. This includes the respective understanding of:
  - Macro-sociological goals and the macro-economic goals for human society that support them.

- Neo-classical (for K0-PF) or strongly sustainable (K0-SS) **micro-sociology and economics** (i.e. organization and management). This includes the respective understanding of:
  - Purpose and micro-economic goals of human organizations.
  - Business design within the above understanding of the problem and solution domains.

While the disciplinary taxonomy is used consistently in sections 4.4-4.6, not all of the above topics are described under each world-view. Table 4-3 shows the coverage of the topics by discipline and world-view.

Topic by World-View / **Topic by Discipline**	**Shared** (K0)	**Profit-First** (K0-PF)	**Strongly Sustainable** (K0-SS)
Formal science			
• Modelling	✓	✗	✗
Natural Science			
• Sustainability and Flourishing	✓	✗	✗
• Human World-Views	✗	✓	✓
• Human and non-Human Needs and Satisfiers	✓	✓	✓
Macro-Sociology & Economics			
• Human Social Goals	✓	✓	✓
Micro-Sociologic & Economics (organization and management).			
• Organizations: Purpose & Goals	✗	✓	✓
• Business Design	✓	✓	✓

Table 4-3: Coverage of Topics by Discipline and World-View

The reason for the incomplete coverage is that for some topics there is unanimity between the neo-classical and ecological world-views; hence the topic will only appear under the shared world view (4.4). For other topics there is a difference in understanding so the topic will appear under both the profit-first and strongly sustainable world views (4.5 and 4.6 respectively). Finally some topics have a combination of shared and divergent understandings: these topics appear under all three.

The **second** of the two clarifying questions the systematic literature review responds to is:

> What detailed design principles (DDP1..n) for the construction of the SSBMO can be derived from this knowledge within the overall design principles (ODP1 and 2):?

The response to this question, the detailed design principles, are presented in K0-Shared (4.4.6), K0-Profit First (4.5.6), K0-Strongly Sustainable (4.6.6) and summarized in 4.7

4.4 The Shared World-View (K0)

4.4.1 Introduction

As summarized in Table 4-3 this section presents knowledge from the problem and solution domains that appear to be held as valid by scholars who take the neo-classical ***or*** ecological stance to business models (and relevant related topics).

4.4.2 Formal Sciences

As summarized in Table 4-3 there is one topic searched in the literature presented in this section: models and modelling.

> *All models are wrong, but some are useful* (Box, 1979, Section heading p.2)
>
> *A […] model […] is valuable insofar as it is useful designing an information system: Certain inaccuracies and abstractions are inconsequential for these purposes* (March & Smith, 1995, p.256)

Hence a business model is 'just' that – a model. Hence like any model it 'only' includes an abstraction of reality as defined by the model's author. In turn an ontology is a meta model and is two abstractions away from 'reality' (Figure 3-10).

There are two views of abstraction that while applicable to many fields (e.g. business, design, art, music, map making etc.), are held to be key from an information systems perspective, each with a different emphasis:

1. "the process of removing detail to simplify and focus attention based on the definitions: The act of withdrawing or removing something, and the act or process of leaving out of consideration one or more properties of a complex object so as to attend to others" (Kramer, 2007, p.38).
2. "the process of generalization to identify the common core or essence based on the definitions: The process of formulating general concepts by abstracting common properties of instances, and a general concept formed by extracting common features from specific examples" (Kramer, 2007, p.38).

Models and modelling are important in the construction of abstract (digital) management Information Systems (IS). A recent text book in this field states:

> *Modelling system requirements is an important part of any IS development methodology. A model is a simplified representation of something real, such as a building, weather pattern, or information system that knowledge-enabled professionals can manipulate in order to study the real item in more detail. […] For IS development, the model usually includes one or more diagrams that developers can use to examine, evaluate, and adjust in order to understand the systems.* (Huber, Piercy, McKeown, & Norrie, 2007, p.220-221)

Writing from the ontology engineering perspective Rothenberg states that:

> *Modeling, in the broadest sense, is the cost-effective use of something in place of something else for some cognitive purpose. It allows us to use something that is simpler, safer or cheaper than reality instead of reality for some purpose. A model represents reality for the given purpose; the model is an abstraction of reality in the sense that it cannot represent all aspects of reality. This allows us to deal with the world in a simplified manner, avoiding the complexity, danger and irreversibility of reality.* (Rothenberg, 1989, p.75).

In a recent article "Business Models as Models" in a special issue on Business Models of Long Range Planning Baden-Fuller and Morgan suggest there are three benefits of this type of model to managers and management scientists (Baden-Fuller & Morgan, 2010):

1. The use of business models as scale and role models to classify businesses in a taxonomy or typology, including the definition of and comparison of businesses to ideal types.

2. The use of business models as instruments of scientific enquiry similar to the 'model organisms' of biology and economics. This allows rigorous investigation of what works and why, not just (as is more typical in management) what is known.

3. The use of business models to capture patterns of successful business design for reuse by mangers or to enable managers to demonstrate the benefits or feasibility of specific business designs.

Modelling is also a critical component of natural science, including climate (change) modelling (Watson & United Nations Environment Programme, 2001) and sustainability modelling (Todorov & Marinova, 2011) as well as in the social sciences, such as in ecological economics (Boumans et al., 2002; Costanza & Ruth, 1998; Meadows, 2005; Nørgård, Peet, & Ragnarsdóttir, 2010; Turner, 2008; Victor, 2008). These models can range from the highly formalized mathematic to the purely informal pictorial.

As the exemplar organizational ontology researchers all noted, models (and ontologies, as meta models, specifically) can help promote more effective and efficient communication (3.5.1.3). The Deming special interest group within the UK Chartered Quality Institute working on a Model of Sustainable (business) Organizations (MoSO) (A. Clark, Rose, Richings, Gall, Peterson, Korycki, Hodges, Ridsdale, Upstone, Pollard, Aitken, Hiscock, Charlton, & Brown, 2009,2010,2011a) provide a summary of all this, aligned with the objectives of this research:

> *A model can be said to be, 'a simplification of reality intended to promote understanding'..*
>
> *The intention of MoSO therefore is to promote understanding of the key elements which make a sustainable organization work, showing how the elements might link together and interact.*
>
> *And a model is never right – but they help people to notice the differences between the model and their reality.*
>
> *Comparing MoSO with a 'picture' of your own organization will help you to think about how your organization works. It should also promote thinking about which of your current processes 'fit' the model, and reveal other aspects which are missing or deserve more understanding or work. Then the challenge is to do something about it!* (A. Clark, Rose, Richings, Gall, Peterson, Korycki, Hodges, Ridsdale, Upstone, Pollard, Aitken, Hiscock, Charlton, & Brown, 2009,2010,2011b)

4.4.3 Natural Sciences

4.4.3.1 Introduction

This review of the natural sciences adds to that already presented in chapter 3 (prepared during preparation activity P2). As summarized in Table 4-3, there are three specific topics searched in the literature presented in this section: the natural science perspectives on sustainability and flourishing, human world-views, and human and non-human needs and satisfiers that are held to be true by questioners irrespective of their world view.

Upon reflection it was realized due to the reflexive nature of sustainability, the ever changing intersection between changing human values and the changing state of the biophysical world (3.4.6), that these topics can be presented in any order, e.g.

- What the natural sciences have to say about sustainability and flourishing shapes human world-views and hence human needs and satisfiers, or
- Human and non-human needs and satisfiers shape human world-views and hence our natural science understanding of sustainability and flourishing, or
- Human world-views shapes human needs and satisfiers and hence our natural science understanding of sustainability and flourishing.

As befitting academic research the choice in this section is to lead with natural science 'truth' and then use this as context to describe the other two topics.

4.4.3.2 Sustainability and Flourishing

In this research it is claimed that irrespective of one's world-view related to the nature and purpose of human organizations (profit first vs. strongly sustainable) the natural science of what constitutes sustainable biophysical and psychological flourishing are, at least in broad strokes, understood by the natural sciences, and hence increasingly uncontroversial: there is little of practical significance to business models in the natural science with which to argue[15].

However, as noted above, it is recognized that this knowledge is not complete in detail (the work of normal science), and like all scientific knowledge is subject to paradigm changing work in the future. Thus a humble stance must be taken recognizing the limits to what is known and how this knowledge may be best applied.

Sustainability

The Shorter Oxford English Dictionary defines the adjective sustainable as:

1. Able to be maintained at a certain rate or level

2. Able to be upheld or defended

(Oxford Dictionaries, 2012c)

As an adjective this immediately prompts the question: what is the noun being sustained? From a natural science perspective this then refers us to the objects within its field of study: the bio-physical.

Starting from the physical perspective the 2nd law of thermodynamics, Non-Equilibrum Thermodynamic theory (NET), suggests that in a semi-open system, such as Earth, in response to available high quality energy “work” may be done which results in a decrease in the quality of the remaining energy (an increase in entropy). In the case of Earth all the available high quality energy originates outside or prior to the Earth’s existence and “work” is any process that elaborates coherent behaviours and self-organization (Eriksson & Robèrt, 1991; J. J. Kay & Schneider, 1994; J. J. Kay, Regier, Boyle, & Francis, 1999; J. J. Kay, 2000; Minkel, 2002; Minkel, 2002).

These elaborative processes generate and evaluate organization within the semi-open system that is planet Earth[16]. The result: over long periods of time the current

[15] That parts of an individual’s world-views unrelated to the nature and purpose of human organizations may cause some or all of the natural science knowledge on sustainability and flourishing to be considered false is discussed in 4.5.3.3.

coherent physical, chemical and biological behaviour and organization emerges. Further, since the sources of high quality energy continue, by the 2nd law, these coherent behaviours and self-organization must also remain (Allen, Tainter, & Hoekstra, 1999; Allen, 2003; E. D. Schneider & Sagan, 2006).

From this, the ultimate limit to the elaboration that can occur in a given ecosystem over time becomes apparent: available high quality energy. For a given level of elaboration to occur and subsequently to remain requires a certain amount of high quality energy. Elaboration will, over time, always match the available energy (increasing or decreasing as the quality or quantity of energy changes).

This reality conflicts with the typical usage of the adjective sustainable: that is it is an adjective to a noun. It is assumed that one can sustain some thing. The natural science perspective above appears to contradict this possibility: the work done as a result of high quality energy may only result in change.

This leads to a question:

> If the bio-physical is always changing based on available high quality energy what constant is there to be sustained except the process of change itself?

The change processes are happening at many scales of time: from very short term life spans of some sub-atomic particles, medium time-frames of the birth life and death of cells, through to the very long term existence of cosmic objects such as stars.

> *Humans are medium-sized objects moving at medium-sized speeds through a medium-sized world* – Richard Dawkins

---

[16] That order does arise and that high quality energy is required to do this is not in dispute. However, for many ***how*** this is true, given the 2nd Law of Thermodynamics requirement to create disorder (entropy), is unclear. The cited authors describe a resolution labelled "non-equilibrium thermodynamics" (NET): Order arises so that the 2nd law and its requirement to create entropy holds, i.e. the self-organized holarchic structures that have developed on planet Earth (life) are the result of and the mechanism to maximize the production of entropy. The evidence presented by these scholars suggests that more entropy is created more quickly as a result of a high diversity of life existing than not. While this theory is controversial, it is perhaps of little of practical significance to business models.

This suggests that in this research the medium speed change processes are what concern us: perhaps ranging from changes that can impact moment to moment human experience to those spanning 'seven generations'.

Within this temporal context, in the late 1980's one trans-disciplinary group of Swedish natural scientists including physicists, chemists, biologists and physicians asked what types of changes would not be compatible with life?[17] They concluded that certain changes to the biosphere from a pre-industrial baseline state would reduce its compatibility with current life (Azar, Holmberg, & Lindgren, 1996; Eriksson & Robèrt, 1991; Holmberg, Robèrt, & Eriksson, 1996; Holmberg & Robèrt, 2000).

This work identified a number of systems' conditions that maximize the likelihood of the biosphere remaining compatible with current life ("the systems conditions for a sustainable society"). Specifically, to maximize compatibility with current life it is recommended to avoid systematically increasing, from pre-industrial levels:

1. Concentrations of substances in the biosphere from the lithosphere[18, 19].
2. Concentrations of previously unknown substances in the biosphere[20].
3. Degradation of the physical conditions for biological production and diversity[21].

Of course the causes of these changes are many and may be non-human in origin. Within the epoch of written human history many events have occurred and are

[17] The process used to answer this question is known as the "consensus process" and was led by Oncologist Dr. Karl-Henrik Robèrt. This subsequently led to the forming of the widely respected Framework for Strategic Sustainable Development, supported by an international alliance of research universities (The Alliance for Strategic Sustainable Development http://www.alliance-ssd.org) and an influential international NGO (The Natural Step http://www.thenaturalstep.org/) (Robèrt, 2002). Searching for criticism of this yielded only one work, in which the criticism is of the practical operationalization of the ideas not the validity of the statements as quoted here (Upham, 2000). Since this article was written the criticism of a lack of natural science evidence for some parts of these statements has at least partially been resolved through the work of Rockström et. al. (Rockström, 2009; Rockström & et. al., 2009)

[18] The semi-open systems of the Earth may be said, starting from its centre, to consist of the: core, mantel, crust, troposphere, stratosphere, mesosphere, thermosphere, and exosphere. The lithosphere consists of the upper most solid portions of the mantel and crust. The biosphere (or ecosphere) consists of the zone in which life occurs.

[19] e.g. as a result of human mining and drilling

[20] e.g. as a result of human manufacturing.

[21] e.g. as a result of human destruction of habitat and species..

expected to continue to occur that broach the above system conditions and as a result materially and negatively impact current life:

- Multiple perturbations in climatic norms due to cycles in the energy output of the sun and the Earth's orbit (Morris, 2010, p.97, p.180, p.206, etc).
- Tectonic processes such as large volcanic eruptions, such as Krakotoa in 1883 (Winchester, 2003)
- Asteroid impact events from the relatively small scale Tunguska event in 1908 to larger events outside of recorded history such as Cretaceous–Paleogene Extinction event approximately 65 millions years BCE.

These Swedish scientists took a biospheric approach to determine the system conditions to maximize compatibility with current life; treating the biosphere as a single integrated system and the pre-industrial state as an advisable baseline.

More recently an international group of scientists started to identify critical sub-systems within the biosphere and their specific boundaries. While this work is not yet complete, it gives more detail of the types of changes to be avoided to maximize compatibility with current life. A summary of this work is shown in Table 4-4.

An even more fine grained view of the planetary sub-systems have been termed eco-system services. This analysis takes a more anthropocentric approach: defining services based on the flows of benefits to humans (and other life) which arise from each service. Further, at this time, due to the complexity and scale of the effort required, limits to the degree of change which these services can undergo without creating incompatibilities with current life is only just being undertaken. It is possible this work will never be comprehensively undertaken given the high degree of variability of ecosystem composition and service performance created by the adaptations in each geographically local occurrence. A summary of this work is shown in Table 4-5 (Boulter, 2011; Boumans et al., 2002; Hanson et al., 2012; Hof & Bevers, 1998; J. J. Kay et al., 1999; J. J. Kay, 2000; TEEB, 2010; Wilson & Howarth, 2002).

Planetary Sub-system[22]		Boundary Parameters	Proposed Boundary	Current Status[23]	Pre-Industrial Value	Limit Exceeded
1	Climate regulation	(i) Atmospheric carbon dioxide concentration (parts per million by volume)	350	387	280	Yes
		(ii) Change in radiative forcing (watts per metre squared)	1	1.5	0	Yes
2	Biodiversity (life / ecologic systems)	Extinction rate (number of species per million species per year)	10	>100	0.1–1	Yes
3	Nitrogen cycle	Amount of N2 removed from the atmosphere for human use (millions of tonnes per year)	35	121	0	Yes
4	Phosphorus cycle	Quantity of P flowing into the oceans (millions of tonnes per year)	11	8.5–9.5	~1	Nearly
5	Stratospheric ozone regulation and maintenance	Concentration of ozone (Dobson unit)	276	283	290	Nearly
6	Ocean pH regulation	Global mean saturation state of aragonite in surface sea water	2.75	2.90	3.44	Nearly
7	Freshwater cycling	Consumption of freshwater (km3 per year)	4,000	2,600	415	No
8	Land use	Percentage of global land cover converted to cropland	15	11.7	Low	No
9	Atmospheric aerosol assimilation	Overall particulate concentration in the atmosphere, on a regional basis	To be determined			
10	Chemical pollution assimilation	For example, amount emitted to, or concentration of persistent organic pollutants, plastics, endocrine disrupters, heavy metals and nuclear waste in, the global environment, or the effects on ecosystem and functioning of Earth system thereof	To be determined			

Table 4-4: Planetary Sub-System Boundaries
(Minor adaptations from Rockström, 2009; Rockström & et. al., 2009)

[22] The geological system of plate tectonics, lithosphere formation and erosion is not included, presumably because so far there is limited evidence for anthropomorphic impacts upon this system.
[23] As of 2009.

Service	Sub-category	Definition	Example of Benefit Flow[24]
Provisioning services: The goods or products obtained from ecosystems			
Food	Crops	Primary production: Cultivated plants or agricultural produce harvested by people for human or animal consumption as food	• Grains • Vegetables • Fruits
	Livestock	Secondary production: Animals raised for domestic or commercial consumption or use	• Chickens • Pigs • Cattle
	Capture fisheries	Secondary production: wild fish captured through trawling and other non-farming methods	• Cod • Crabs
	Aquaculture	Primary and / or secondary production: Fish, shellfish, and/or plants that are bred and reared in ponds, enclosures, and other forms of freshwater or saltwater confinement for purposes of harvesting	• Shrimp • Oysters • Salmon
	Wild foods	Primary and / or secondary production: Edible plant and animal species gathered or captured in the wild	• Fruits and nuts • Fungi • Bushmeat
Biological raw materials	Timber and other wood products	Primary production: Products made from trees harvested from natural forest ecosystems, plantations, or non-forested lands	• Industrial roundwood • Wood pulp • Paper
	Fibres and resins	Primary production: Non-wood and non-fuel fibres and resins	• Cotton, silk, hemp • Twine, rope • Natural rubber
	Animal skins	Secondary production: Processed skins of cattle, deer, pig, snakes, sting rays, or other animals	• Leather, rawhide, cordwain
	Sand	Sand formed from coral and shells	• White sand from coral and white shells; • Colored sand from shells
	Ornamental resources	Physical, chemical, primary or secondary production: Products derived from ecosystems that serve aesthetic purposes	• Tagua nut, wild flowers, coral jewelry
Biomass fuel		Primary and / or secondary production: Biological material derived from living or recently living organisms—both plant and animal—that serves as a source of energy	• Fuelwood and charcoal • Grain for ethanol production • Dung
Freshwater		Inland bodies of water, groundwater, rainwater, and surface waters for household, industrial, and agricultural uses	• Freshwater for drinking, cleaning, cooling, industrial processes, electricity generation, or mode of transportation
Genetic resources		Primary and / or secondary production: Genes and genetic information used for animal breeding, plant improvement, and biotechnology	• Genes used to increase crop resistance to disease or pests
Bio-chemicals, natural medicines, and pharma-ceuticals		Primary and / or secondary production: Medicines, biocides, food additives, and other biological materials derived from ecosystem for commercial or domestic use	• Echinacea, ginseng, garlic • Paclitaxel as basis for cancer drugs • Tree extracts used for pest control

[24] Despite using terminology like: eco-system services produce a flow of benefits, the examples provided are not all directly worded as "flows of benefits"; in many cases they are simple examples of the bio-physical stocks made available and of benefit to humans, i.e. an instance of a flow. The reader is encouraged to consider how the quantity and quality of each bio-physical stock mentioned per unit of time results in benefits to human (and other life).

Service	Sub-category	Definition	Example of Benefit Flow[24]
Regulating services: The benefits obtained from an ecosystem's control of natural processes			
Maintenance of air quality		Influence ecosystems have on air quality by emitting chemicals to the atmosphere (i.e., serving as a "source") or extracting chemicals from the atmosphere (i.e., serving as a "sink")	• Lakes serve as a sink for industrial emissions of sulphur compounds • Tree and shrub leaves trap air pollutants near roadways
Regulation of climate	Global	Influence ecosystems have on the global climate by emitting greenhouse gases or aerosols to the atmosphere or by absorbing greenhouse gases or aerosols from the atmosphere	• Forests capture and store carbon dioxide • Cattle and rice paddies emit methane
	Regional and local	Influence ecosystems have on local or regional temperature, precipitation, and other climatic factors	• Forests can impact regional rainfall levels
Regulation of water timing and flows		Influence ecosystems have on the timing and magnitude of water runoff, flooding, and aquifer recharge, particularly in terms of the water storage potential of the ecosystem or landscape	• Permeable soil facilitates aquifer recharge • River floodplains and wetlands retain water—which can decrease flooding— reducing the need for engineered flood control infrastructure
Erosion control		Role ecosystems play in retaining and replenishing soil and sand deposits	• Vegetation such as grass and trees prevents soil loss due to wind and rain and prevents siltation of waterways • Coral reefs, oyster reefs, and sea grass beds reduce loss of land and beaches due to waves and storms
Water purification and waste treatment		Role ecosystems play in the filtration and decomposition of organic wastes and pollutants in water; assimilation and detoxification of compounds through soil and subsoil processes	• Wetlands remove harmful pollutants from water by trapping metals and organic materials • Soil microbes degrade organic waste, rendering it less harmful
Disease mitigation		Influence that ecosystems have on the incidence and abundance of human pathogens	• Some intact forests reduce the occurrence of standing water—a breeding area for mosquitoes—which lowers the prevalence of malaria
Maintenance of soil quality		Role ecosystems play in sustaining soil's biological activity, diversity and productivity; regulating and partitioning water and solute flow; storing and recycling nutrients and gases; among other functions	• Some organisms aid in decomposition of organic matter, increasing soil nutrient levels • Some organisms aerate soil, improve soil chemistry, and increase moisture retention
Pest mitigation		Influence ecosystems have on the prevalence of crop and livestock pests and diseases	• Predators from nearby forests—such as bats, toads, and snakes—consume crop pests
Pollination		Role ecosystems play in transferring pollen from male to female flower parts	• Bees from nearby forests pollinate crops
Natural hazard mitigation		Capacity for ecosystems to reduce the damage caused by natural disasters such as hurricanes and tsunamis and to storm surges maintain natural fire frequency and intensity	• mangrove forests and coral reefs protect coastlines from • Biological decomposition processes reduce potential fuel for wildfires

Service	Sub-category	Definition	Example of Benefit Flow[24]
Cultural services: The nonmaterial benefits obtained from ecosystems			
Recreation and ecotourism		Recreational pleasure people derive from natural or cultivated ecosystems	• Hiking, camping, and bird watching • Going on safari • Scuba diving
Ethical and spiritual values		Spiritual, religious, aesthetic, intrinsic, "existence," or similar values people attach to ecosystems, landscapes, or species	• Spiritual fulfillment derived from sacred lands and rivers • People's desire to protect endangered species and rare habitats
Educational and inspirational values		Information derived from ecosystems used for intellectual development, culture, art, design, and innovation	• The structure of tree leaves has inspired technological improvements in solar power cells • School fieldtrips to nature preserves aid in teaching scientific concepts and research skills
Supporting services: The natural processes that maintain the other ecosystem services			
Habitat		Natural or semi-natural spaces that maintain species populations and protect the capacity of ecological communities to recover from disturbances	• Native plant communities often provide pollinators with food and structure for reproduction • Rivers and estuaries provide nurseries for fish reproduction and juvenile development • Large natural areas and biological corridors allow animals to survive forest fires and other disturbances
Primary production		Formation of biological material by plants through photosynthesis and nutrient assimilation	• Algae transform sunlight and nutrients into biomass, thereby forming the base of the food chain in aquatic ecosystems
Secondary Production		Formation of biological materials by animals through ingestion of plants or other animals	• Herbivores and carnivores consume the results of primary production to live and reproduce
Nutrient cycling / Assimilation		Flow of nutrients (e.g., nitrogen, sulphur, phosphorus, carbon) through ecosystems; Taking of organisms wastes and transforming them into useful / non-harmful stocks	• Transfer of nitrogen from plants to soil, from soil to oceans, from oceans to the atmosphere, and from the atmosphere to plants
Water cycling		Flow of water through ecosystems in its solid, liquid, or gaseous forms	• Transfer of water from soil to plants, plants to air, and air to rain

Table 4-5: Definitions of Ecosystem Services
(Derived from Hanson et al., 2012, Table 2, pp.4-5)

Within the same medium speed temporal context other scientists have been seeking to understand if there are common meta-processes occurring across multiple heterogeneous systems of biological systems (i.e. ecosystems), irrespective of specific change processes. Observations of a number of highly diverse eco-systems over time led Holling to develop the panarchy heuristic model of "adaptive renewal". The panarchy model is shown in Figure 4-4.

The panarchy model suggests that any ecosystem change will, over time, necessarily go through four phases: growth (exploitation), accumulation (conservation), restructuring (release), and renewal (reorganization). Each of these four phases is differentiated both by the level of connectedness of the parts within the ecosystem and by how actively capital is created or captured. The transition from one phase to another is triggered by a change in the context of the ecosystem under study. Further these phases may be nested at different scales of time and space. i.e. a ecosystem change which is small and fast may trigger a shift in a larger scale system from accumulation to restructuring; or an ecosystem change which is large and slow may trigger a shift in a medium scale system from renewal to growth.

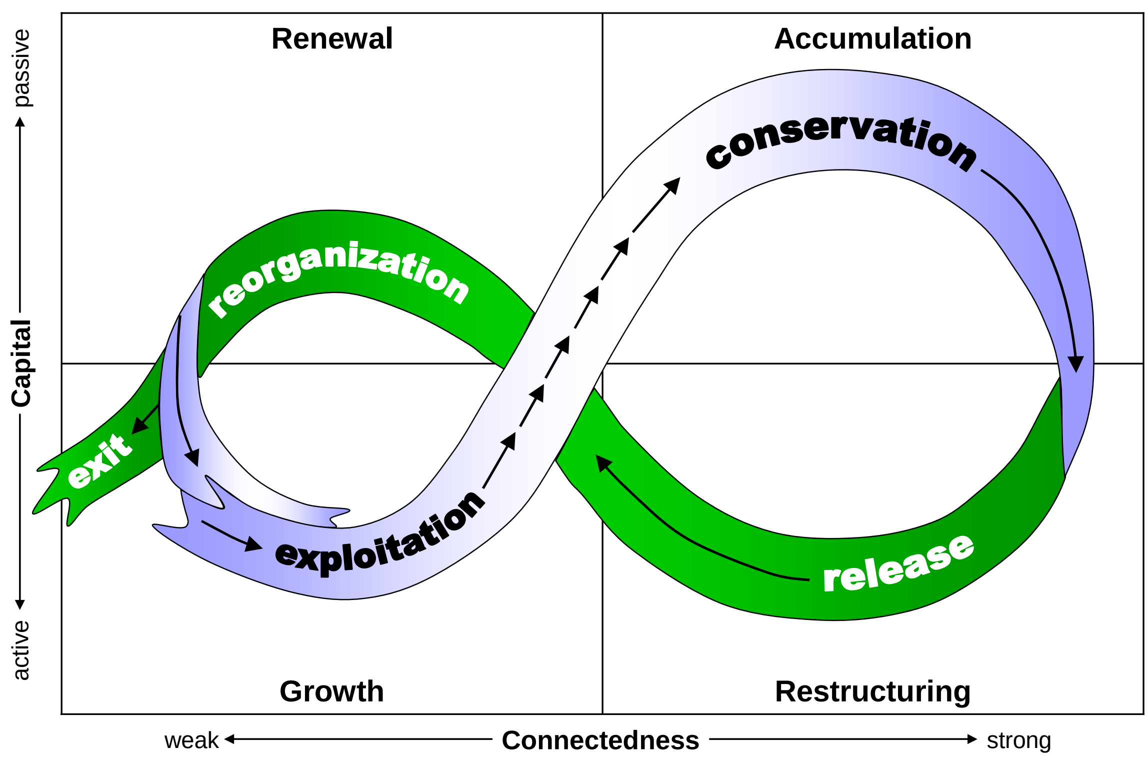


Figure 4-4: Stylized Panarchy Model of the Four Ecosystem Phases
(Adapated with permission of Island Press, with kind permission of Springer Science+Business Media from Holling, 2001, Fig.4 p.393.)

This model provides insight into ecological change processes: non-human and human[25]. It suggests that both growth and (creative) destruction are important:

> *Disturbance is part of development, and periods of gradual change and periods of rapid transition coexist and complement each other* (Folke, 2006, p.258)

The above summarizes the natural science literature related to the macro and ever changing processes (and hence state) of our semi-open system: planet earth. This is the context in which humans might wish to attempt to sustain.

Before moving on, applying synthesis, there is one other aspect of these elaborative processes that is also a focus of the natural sciences: the stocks of atoms, molecules, compounds and cells which are transformed by the work of these processes.

> *Stocks are accumulations. They characterize the state of the system and generate the information upon which [processes act]. Stocks give systems inertia and provide them with memory. Stocks create delays by accumulating the difference between the inflow to a process and its outflow. By decoupling rates of flow, stocks are the source of disequilibrium dynamics in systems* (Sterman, 2000, p.192)

Stocks related to ecosystems are often known as biophysical stocks. For any given system under exploration (such as a business model) the relevant biophysical stocks will be those atoms, molecules and cells that remain unchanged or are transformed by the processes within the system. As per the law of conservation of mass, there is no

[25] It appears that some historians have started to implicitly apply the panarchy model to the processes of human history. History is then seen as a necessarily reflexive process involving an ever changing interaction between geography, energy capture, social organization/conflict and information with phase changes being triggered by five factors seen as coming from outside the culture being described: climate change, migration, famine, epidemic and state failure.

As a specific examples: this approach to history recognizes the importance for human renewal (i.e. adaptation of a group of humans) of "backwardness" – i.e. it is not the group that is currently most advanced (the panarchy growth or accumulation phase) that is best placed to quickly adapt ("The Advantage of Backwardness" Morris, 2010p. 33-34, etc.). Rather it is the groups that are undergoing restructuring or renewal which are best positioned to adapt in light of changed context.

'away': biophysical stocks may only be left as is, or transformed into another biophysical stock as a result of a process. Under no circumstances do biophysical stocks leave the biosphere[26].

Biophysical Stock	Description	Example
Chemical elements	As per the periodic table	Oxygen (O), Hydrogen (H), Iron (Fe), etc.
Non-organic chemical compounds	Any combination of chemical elements not including carbon	Ozone (O_3), Water (H_2O), etc.
Organic chemical compounds	Any combination of chemical elements including carbon	Methane (CH_4)
Non-cellular life	Any organism without a cellular structure comprised of organic compounds but possibly requiring non-organic compounds	Viruses
Cellular life	Any organization consisting of one or more cells comprised of organic compounds but possibly requiring non-organic compounds	Bacteria, Archaea, Eukarya (Protista, Fungi, Plantae, Animalia)

From these stocks all inputs to and outputs from human organizations may be derived whether intended or unintended, whether valued (aesthetically, practically[27], monetarily) or not, e.g. 'consumable', 'finished good', vs. 'waste' (packaging, post consumer, created by or during use).

Table 4-6: Definitions of Biophysical Stocks
(Derived from Hanson et al., 2012)

Despite extensive searching, no list of Bio-Physical Stocks directly useful to business model designers was found. A useful list of bio-physical stocks relevant to human organizations may be derived from the list of ecosystems services (Table 4-5) by

[26] For (all) processes relevant to human organizations on planet Earth, except perhaps those launching artefacts outside the exosphere.
[27] i.e. valued for its utility.

asking what atoms, molecules or cells comprise or are transformed by each service. The starting point for such a list is presented in Table 4-6[28].

Resilience

The Shorter Oxford English Dictionary defines the adjective resilient as:

> *1. (of a substance or object) able to recoil or spring back into shape after bending, stretching, or being compressed*
>
> *2. (of a person or animal) able to withstand or recover quickly from difficult conditions*
>
> (Oxford Dictionaries, 2012b)

Within the temporal context of medium speed change in the biosphere, natural science has started to consider what are the processes and properties of physical, chemical and biological systems that allow them to continue despite such unrelenting change: i.e. what changes a system's resilience to change? Answering this question enables the possibility of design principles whose application could lead to humans being able to create more artefacts more resilient to certain types or amounts of change in given contexts (such as human organizations).

The Rockerfeller Foundation's "Resilience Initiative" recently sponsored a review of the resilience literature spanning the natural, social and design sciences. Scholars from the City University of New York and Arizona State reviewed approximately 140 works, with the purpose of enabling the "rigorous application of the concept of resilience" based on an inter-disciplinary foundation (Martin-Breen & Anderies, 2011, p.2).

This review of the literature opened by suggesting that resilience is a matter of trade-offs. For example creating resilience always involves a cost (time, energy, etc.); This implies not doing something else and a choice of which has the higher value that may

[28] An example of a list of biophysical stocks relevant for an organization is presented in an instance of the SSBMO produced as part of its evaluation (See supplementary materials SM6a and SM6b).

need to be revisited in light of ever changing context[29]. Hence, various resilience frameworks (common sense, robustness and complex adaptive systems) offer a "choice of perspective; the acceptability trade-offs between [perspectives …] will ultimately determine which perspective is chosen" (p. 5).

Others have noted the criticality of the panarchy model (Figure 4-4) to understanding and designing for resilience: if ecological processes must perforce periodically undergo the four phases (growth, accumulation, restructuring and renewal) to increase the resilience of any thing or process requires it surviving the uncertainties and dynamics of these four phases (Folke, 2006, pp.258-259).

The originator of the panarchy model, Holling, suggested that the model also includes resilience and this is a 3rd dimension (along with capital and connectedness) (Holling, 2001, p.395). This is shown in Figure 4-5, in which the earlier two dimensional figure is projected into the third dimension of resilience.

This perspective suggests that a given system undergoing change (triggered by external events) has different levels of resilience, given its existing organization, depending the panarchy phase. Systems undergoing the reorganization (release) and growth (exploitation) phase have more resilience than the same system which is accumulating (conservation) or renewing (reorganization).

[29] The author's internet phone provider suffered its first ever 100% failure in service as a result of both their independent power feeds being turned off by the local electrical during the recent precedent setting storms in the North East U.S. in order to protect equipment from catastrophic damage by sea water ('Hurricane Sandy' Late October 2012). In personal communication with the company's Chief Technology Officer it became apparent that their appreciation of the changing likelihood of such events (due to anthropomorphic climate change) was a contributing factor in their trade-off decision not to incur the (significant) costs to improve their resilience through geographically dispersed equipment.

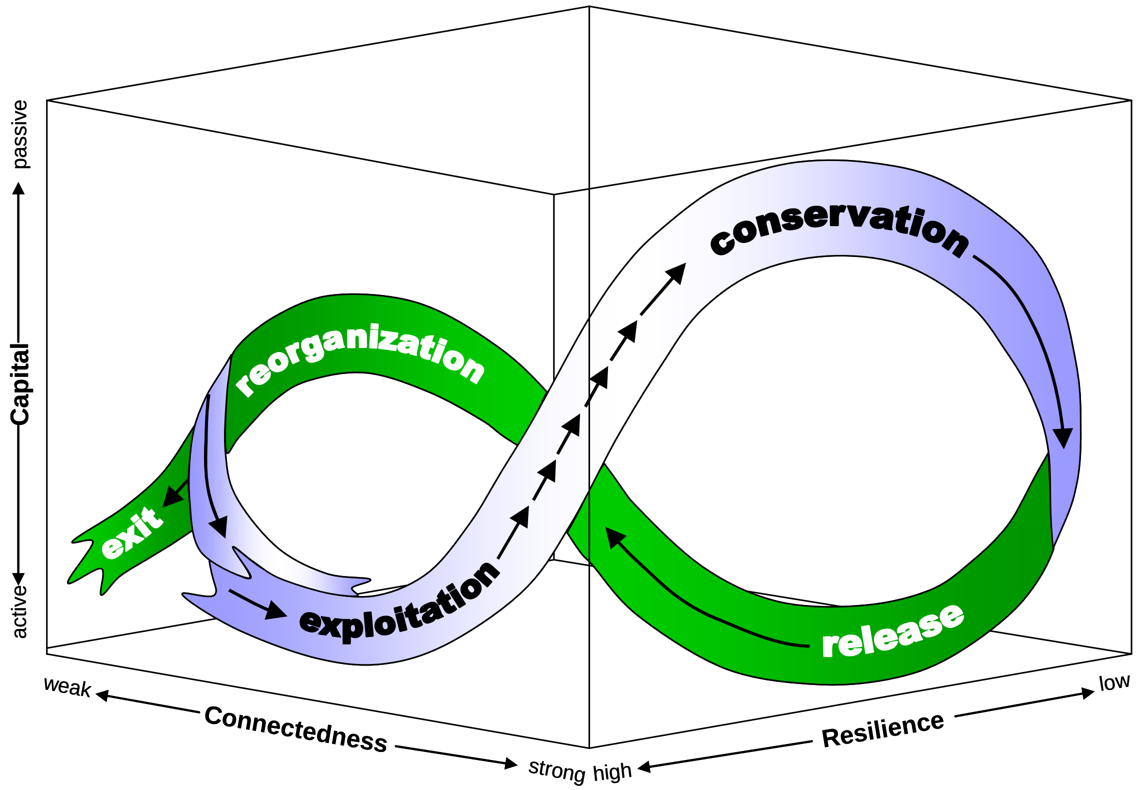


Figure 4-5: Resilience – the Third Dimension of the Panarchy Model
(Adapted with permission of Island Press, with kind permission of Springer Science+Business Media from Holling, 2001, Fig.5 p.395)

Flourishing

The Shorter Oxford English Dictionary defines the verb to flourish as:

> *[no object] (of a living organism) grow or develop in a healthy or vigorous way, especially as the result of a particularly congenial environment.*
>
> (Oxford Dictionaries, 2012a)

There is no singular objective definition of biological flourishing, or even it's opposite: an absence of life. However, there is a general sense of a range of behaviours that indicate the state of an organism:

- From: Languishing, enduring or merely surviving and hence closer to death, i.e. not respirating, not obtaining (food) energy, etc.
- To: Flourishing and hence purposefully avoiding death of itself and its species, i.e. reproducing, proactively gaining information to aid continued existence, etc.

Building on this, specifically from the perspective of the human species, in the last decade or so the field of positive (human) psychology has arisen with a call to action based on a normative goal:

> *To achieve the goal of widespread mental health, therefore, […] psychology as a whole should think about flourishing and languishing. We must work together to study and promote 'that which makes life worthwhile'.* (Keyes & Haidt, 2003, p.14).

This movement has led to attempts to define human flourishing:

> *To live within an optimal range of human functioning, one that connotes goodness, generativity, growth, and resilience. […] Flourishing contrasts not just with pathology but also with languishing: a disorder intermediate along the mental health continuum experienced by people who describe their lives as 'hollow' or 'empty'* (Fredrickson & Losada, 2005, p.678)

The emergence of positive psychology as an accepted field of medical science is recent. Hence clear guidelines for the reliable, efficient and effective achievement of human flourishing are not yet at the stage of scientific consensus. However results of much experimentation appears encouraging, such that guidelines to achieve flourishing are now possible (Kabat-Zinn, 1990; Kabat-Zinn, 2005; Williams, Teasdale, Segal, Kabat-Zinn, & Sounds True, 2007).

As part of this exploration, some positive psychology researchers have written extensively about the value and reliability of some of the guidelines for humans to individually and collectively achieve flourishing provided by widely accepted historical works[30] (Goleman, 1997; Goleman, 2004; Haidt, 2006; Harris, 2004, pp.170-204).

This suggests that flourishing is a possible condition for biological systems, albeit one which requires choice; further that for purposeful ideal-seeking systems, such as humans, guidelines are emerging which, if followed, enable attempts at flourishing to be sustematically undertaken.

Summary

From a natural science perspective there is no process or thing that can be sustained. All that may be attempted to achieve the flourishing of human and other life is to design resilient systems: systems that efficiently and effectively satisfy human and non-human needs over time within known limits while avoiding systematically decreasing the biospheric systems' conditions compatible with current life.

One notable industrial ecologist, citing much of the evidence presented above, has coined the aspirational colloquial definition of sustainability already presented (3.4.6.1), that appears to recognize this finding:

> *Sustainability is the possibility that human and other life will flourish on this planet forever* (Ehrenfeld, 2008, p.6)

Hence, perhaps it is the intent behind and in the attempt of its achievement that the use of the word 'sustainable' should be judged, rather than a practical result. i.e. natural science suggests that sustainable as an adjective is oxymoronic, but as a noun (sustainability), verb (to sustain) or adverb (sustainably) it is not (Ehrenfeld, 2008, p.137).

[30] i.e. Upanishads, Bhagavad Gita, the sayings of the Buddha, the Analects o Confucius, the Teo te Ching, the writings of Meng Tzu, Old and New Testiment, Greek and Roman Phisosphers, the Koran, modern Western philosophy and literature (Haidt, 2006, p.x)

In the context of human flourishing, attempting to sustain is a process:

- Whose result is determined by "the interplay between a continuously evolving state of nature and a continuously changing state of mind [i.e. based on human values which are always evolving, and not] a (static) ecological condition" (Introduced in 3.4.6.1 from Allen, 2003, p.23 & p.381).

- That "maintains or fosters the system contexts that produce the goods, services and amenities that people need [to flourish] at an acceptable cost" (Allen, 2003, p.26).

- Requiring active choices, not a passive consequence of doing less (p.12). The process of choosing must at a minimum answer "of what, for whom, for how long and at what cost" is the attempt at sustaining directed (p.26). This work, in its description of biomes and populations would imply location or a physical boundary must also be chosen (i.e. 'where' is also important).

- "Of continually adjusting to changing circumstances, which we do through our problem solving institutions". "Thus a primary characteristic of a sustainable society is that it will have sustainable institutions of problem solving" (p.381) and that these institutional arrangements need to urgently "produce knowledge [of what constitutes sustainability] more rapidly than the growth of unsustainable complexity" (p.161; Homer-Dixon, 2001).

This understanding of the process of attempting to sustain and its natural science context implies that:

- "The things [or processes] we want to sustain have only the values we assign to them, which are [hence] transient, variable and mutable" (p.381).

- What we might choose to attempt to sustain are thermodynamically "unlikely configurations" (i.e. far from equilibrium states) and hence there will always be a "cost of critical inputs that hold the systems dynamically away from the (thermodynamically) dead state" (p.335). Only humans can judge, based on their values, whether the cost of those inputs is warranted.

- Practices which are clearly incompatible with current life and the ultimate limits on and of our planet (as per the natural science), can paradoxically sometimes improve human well-being (pp.79-81)[31].
- Whether something has been successfully sustained
  - May only be assessed in hindsight (p.199).
  - Will change depending on the discreetness of observation (pp.275-6)[32].
- As an emergent property, taking all the necessary actions based on our tacit and explicit knowledge (i.e. monitoring, predicting and problem solving), is no guarantee of success (p.161).

---

[31] "This is part of the dilemma of sustainability. Intelligent and well-meaning people can review indicators of sustainability and reach quite opposite conclusions about our future. Moreover, they could all be correct." (Allen, 2003, p.81)

"What if renaissance Britons had practiced sustainable forestry and so did not need to use coal, perfect the steam engine, or build canals and railways?" … "Without the *early* need to develop systems to produce, distribute and use coal, how would the pattern of industrialism have differed in time, place or form? Perhaps [late 19th century] Western Europe would have been like pre-Revolutionary Russia, a land of wood-dependent, under-producing peasants [with plenty of time spent not fulfilling basic needs, but with a lower level of 'development' …]. Scarcity [e.g. in this case of energy due to exhaustion of forests] spurs innovation [e.g. of coal extraction, transport, use, and hence] to what we commonly call progress. Conversely, to live sustainably and preclude the inventive to innovate may be to forego potentially desirable futures. Surely few Western European's today would prefer that their ancestors had practiced sustainable forestry if that would mean that their economic (social, health) status would be no higher than that of the average Russian." (pp.80-81)

[32] The community which is attempting to sustain may be defined at many scales i.e. the boundary of the community can be defined in terms of a its position on a hierarchy of physical scale: organisms, landscapes, populations, a biome, and / or the biosphere. But clearly defining a boundary for a specific community in order to determine the answer to the key question of sustainability (of what, where, for whom, for how long and at what cost) is difficult, perhaps paradoxically impossible. If a community is defined at the scale between:

- Organism and landscape then "the difficulty [in defining the community] is in the deep intangibility of community structure and the richness of the dynamics associated with that structure" (Allen, 2003, p.275).
- Population and biome then the difficulty in defining a community is in resolving the tension between the environmentally deterministic biome and the bio-feedback processes which define population (p.276).

- “While social justice is part of sustainability, and that democratic systems appear to be the best way of achieving that, it is irresponsible to allow populist demands to destroy the means of production (i.e. the eco-systems within the biosphere)” (p.413).
- The cost of additional complexity in solutions (e.g. as a result of increased public participation or required by democratic processes) is no guarantee that resultant solutions are better enough to justify the incremental costs (environmentally, socially, economically) (p.162).
- The realist position on sustainability is not explicit enough because realists claim the need to consider all “infinity of details in reality” in policy and management. This appears to support a pragmatic philosophical stance and a design approach to sustainability since this could be “explicit and flexible” and provide an “explicit definition and purpose” but “flexible / deliberate in choice of execution” (pp.167-8).

Thus, paradoxically, sustainability can never be a passive or absolute condition – there can never be a sustainable anything: it is an active condition requiring continuous choice in light of continuous change; hence (normative) human values play a role in determining which satisfiers are deemed most valuable at fulfilling needs (p.12).

This contrasts strongly to other approaches to understanding sustainability that tend to include normative values within the definitions (often implicitly). As a result this approach to understanding sustainability, and perhaps because it is paradoxical, reduces the need for a particular world-view to be held in order to agree with it. On this basis this definition is included in the shared world-view category of this systematic literature review.

To conclude this review of the natural science related to sustainability some observations on how this knowledge appears to contradict some (very) commonly understood mechanisms of sustainability:

- Doing less of anything (in absolute terms) may decrease unsustainability but will not increase sustainability. Directly attempting to create a desired condition to be sustained, or stopping something and waiting for the never ending process of change to create that condition, is not the same as doing less of anything.
- Purposefully attempting to sustain any process, thing or state is ultimately oxymoronic.
  - Firstly, the never ending processes of change, driven by high quality energy from the sun, will cause all processes, things and states to change, albeit perhaps very slowly.
  - Secondly, as a result, it is only possible to attempt to create conditions that may increase resilience to certain changes.
- Purposefully restoring anything ‘back’ to a former state is oxymoronic.
  - Firstly the former state would have changed in all cases (albeit perhaps slowly).
  - Secondly there is ultimately no privileged ‘better’ state. The continued availability of high quality energy and hence the continued operation of the overall change processes, coupled with the occurrence of non-human caused events, may lead to the contravention of the biospheric systems’ conditions; further, in turn, this may ultimately lead to a greater quantity and more elaborate life emerging[33].

[33] The classic example being the previously referred to Cretaceous–Tertiary Extinction event and the subsequent elaboration of life including homo-sapiens.

- Purposefully developing anything ‘novel’ has limits, ultimately imposed by available high quality energy and human values, if the process of development and the resultant novelties are to be:
  - Compatible with existing life, and
  - Highly resilient to subsequent change.

Of course none of this means the common uses of ‘sustainable’, oxymoronic to natural science definitions, are likely to cease: the title of this thesis is but one example. It was chosen not for its compatibility with natural science, but to attract readers who perceive they have a specific problem related their organization.

Summarizing: natural science suggests that sustainability is technically impossible to achieve, but improving resilience to change may be attempted:

> *You cannot step in the same river twice* – Heraclitus as summarized by Simplicius
>
> Explanation: The water molecules are not the same ones, and neither is the person stepping nor the bank from which they step.

4.4.3.3 Human World-Views

That much has been written on philosophy through out recorded history is an under-statement. From the critically pragmatic stance of this research, in this section on shared world-views, all that should be restated from Chapters 2 and 3 is the importance of those world-views that appear likely to materially impact the nature of a business design.

From the search of the literature it would appear that for strongly sustainable organizational design, world-views on the continuum of profit-first to strongly sustainable matter; i.e. where a business designer is on this continuum will materially change the nature of the business models produced.

The knowledge relevant to business models based on these stances is presented in the following two sections (4.5 and 4.6).

4.4.3.4 Human and non-Human Needs and Satisfiers

Within the context of surviving, languishing and flourishing scholars have suggested that human needs are few, finite and universal. However the manner in which needs may be satisfied ('satisfiers') is infinite and may vary based on technological, geographic and / or cultural factors (Max-Neef et al., 1991; Tay & Diener, 2011).

An early taxonomy of universal needs was proposed by Maslow as a hierarchy. Often reproduced without the top two levels[34] Table 4-7 shows all seven levels:

7. Aesthetic
6. Know & Understand
5. Self-actualize
4. Esteem or Ego
3. Love & Belonging
2. Safety & Security
1. Physiological

Table 4-7: Maslow Hierarchy of Needs
(Maslow, 1970, first published 1954, ch.4)

Max-Neef more recently proposed a non-hierarchical view of 9 universal human needs[35] and provided examples of satisfiers grouped into four categories, as shown in Table 4-8:

[34] Maslow himself suggested these may form a separate hierarchy (Maslow, 1943, p.385)
[35] Excepting subsistence, that is needs related to physiological well-being. Some, including Max-Neef, suggest that a 10th universal need is transcendence (Woiwode, 2011).

Needs according to existential categories / Needs according To axiological categories	Being (qualities)	Having (things)	Doing (actions)	Interacting (settings)
Subsistence				
Protection				
Affection				
Understanding				
Participation		**Satisfiers**		
Leisure				
Creation				
Identity				
Freedom				

Table 4-8: Max-Neef Matrix of Fundamental Human Needs
(Max-Neef et al., 1991, Table 1 pp.32-33)

Max-Neef explained the four existential categories of attributes of satisfiers as follows:

> *Being: personal or collective satisfier attributes: expressed as nouns.*
>
> *Having: satisfier attributes related to institutions, social norms, mechanisms, tools (not in a material sense), laws, etc.: expressed in one or more words.*
>
> *Doing: satisfier attributes related to actions, personal or collective: expressed as verbs.*
>
> *Interacting[36]: satisfier attributes related to locations and milieus (as times and spaces).* (Max-Neef et al., 1991, Table 1 p.33)

[36] "It stands for the Spanish 'estar" or the German 'befinden', in the sense of time and space. Since there is no corresponding word in English, Interacting was chosen á faut de mieux." (Max-Neef, Elizalde, & Hopenhayn, 1991, Table 1 p.33)

Max-Neef observed that a single satisfier (a mechanism) may or may not have all the identified attributes, and may (apparently) meet one or more needs. In recognition of this he suggested a typology of five categories of satisfiers. In this he takes a reflexive approach to understanding how satisfiers meet or fail to meet needs over time[37]:

1. **Violators or Destroyers**: "of paradoxical effect; Applied under the pretext of satisfying a given need, they not only annihilate the possibility of its satisfaction, but also render the adequate satisfaction of other needs impossible" (Table 2 p.33).

2. **Pseudo-Satisfiers**: "stimulate a false sensation of satisfying a given need. Although they lack the aggressiveness of violators, they may on occasion annul in the medium term the possibility of satisfying the need they were originally aimed" (Table 3 p.35).

3. **Inhibiting Satisfiers**: "satisfy (actually over satisfy) a given need seriously impairing the possibility of satisfying other needs." (Table p.35).

4. **Singular Satisfiers**: Satisfy a "single need and are, therefore, neutral as regards the satisfaction of other needs" (Table 5 p.36).

5. **Synergistic Satisfiers**: "satisfy a given need, stimulate and contribute to the simultaneous satisfaction of other needs" (Table 6 p.36).

Most recently working with Jolibert, Max-Neef has examined the applicability of his model of universal human needs and diverse satisfiers to non-human animals. This examination builds on the Actor Network Theory of Latour and others (Latour, 2005) that argues that a sense of collectivity and agency in social networks requires the inclusion of the human and non-human. Jolibert et. al concluded in the example they considered that:

> *By widening [Max-Neef's] matrix [of fundamental needs] to include non-humans, we shift from a more anthropocentric human needs-based approach to a more global and ecosystemic one, thus creating not only a better understanding of conflicts between*

[37] Max-Neef's words strongly recall the well known system archetypes (Senge, 1990, pp.378-390) – e.g. Max-Neef's description of pseudo-satisfiers appears similar to the "fixes that fail" system archetype and / or the "shifting the burden" archetype. The latter archetype is used by Ehrenfeld to identify addiction to certain pseudo-satisfiers as a root cause of human unsustainability (Ehrenfeld, 2008, pp.10-31).

> *humans but also easing the task of resolving them. It also provides an adequate starting point for the acknowledgment of forms of human dependence and vulnerability that informs basic concerns with sustainability* (Jolibert, Max-Neef, Rauschmayer, & Paavola, 2011, p.267)

As further evidence of plants and non-human animals having needs to which satisfiers exist one may also turn to:

- Applied biology (agronomy and animal husbandry) focused on raising (and harvesting) healthy crops and livestock.
- Large numbers of human NGO's whose stated mission is to represent, within human decision making processes, the needs of the non-human and to ensure the continued availability of appropriate satisfiers (Conroy, 2007).

In both these cases these human behaviours are ultimately (and some might argue cynically) motivated by the requirement of humans to meet their needs; never the less this requires understanding and satisfying the needs of non-human life.

4.4.3.5 Concluding on the Natural Sciences

The natural science works reviewed suggest a working definition of value in the context of business models:

Value is the perception by a human or non-human actor of a need being met measured in aesthetic, psychological, physiological, utilitarian and / or monetary terms.

The natural science works reviewed also suggest a definition of the process of value creation and destruction.

Value is:

- Created when needs are met via satisfiers that align with the recipient's world-view.
- Destroyed when previously met needs go unmet due to: the withdrawal of satisfiers, the application of inappropriate (pseudo) satisfiers, or the application of satisfiers that do not align with the recipient's world-view.

Hence world-view, or values, describes what an individual or group believes is good or right. ODP2 takes an empathetic stance to the users of the SSBMO. This means that there is no judgement of moral or ethical rightness included in the ontology. Some might consider this risky or unwise enabling a small number of extremists use the tool to claim the SSBMO validates their (moral) position. However, the alternative would be to make the SSBMO prescriptive, and this would surely drive away the vast majority of users who might gain some small benefit from its use (3.5.1.5).

4.4.4 Macro- Sociology and Economics: Human Social Goals

As summarized in Table 4-3 there is one topic searched in the literature presented in this section: what, if any, goals for society exist independently of a questioner's world-view on the profit-first to strong sustainability continuum?

The answer (unsurprisingly) appears short. The one agreed goal of human society is to attempt to meet some or all of the universal human needs to some degree (Table 4-8). At least implicitly this is acknowledged as happening via satisfiers aligned with the world-view of the person or group with the needs, i.e. to use the definition above: maximize value creation and minimize its destruction.

It is apparent that many universal human needs cannot be (fully or even partially) satisfied by individuals acting in the world alone (e.g. affection, understanding, participation, leisure, identity, freedom). Further, many satisfiers require the co-ordinated application of resources of many individuals (Ouchi, 1980). This may be driven by:

- Do-ability, i.e. the satisfier may not be undertaken by an individual acting alone due to a physical or psychological limit, or
- Cost, i.e. an individual attempting to meet a need perceives the cost of doing so as too high: it takes too long or requires too many resources (insufficient efficiency), it does not generate enough satisfaction (insufficient effectiveness), or it would destroy value – aesthetic, practical or monetary (insufficient outcome).

From these realities, acknowledged irrespective of world-view, comes the understanding that humans must act collectively to attempt to meet some of their needs. Thus the apparently universal requirement for human societies to allow and enable human's to organize and act collectively.

Within this universal however, Ouchi (1980) also reviews a number of theories that are world-view dependent, on why individuals (often) choose to formalize their co-ordinated efforts. Recognizing the possibly infinite number of way in which satisfiers can meet needs and hence generate value, it appears all these theories have in common the idea that:

Human organizations are brought into being by groups of humans because by doing so they provide individual humans inducements (perceived value received) that exceeds their individual contributions (perceived value lost).

This aligns with Gharajedaghi's (Gharajedaghi, 2011, pp.10-13) observation (introduced in 3.5.3.2) that organizations are socially constructed by all the (self-selected) stakeholders of the organization (the multiple minds who see value in the organizations purposes and processes) based on their collective ideal of the desired value the organization should produce.

Differences of power occur between humans, groups of humans and humans and non-humans. Whether intended or unintended it is possible for an organization to destroy value for the less powerful while creating value for the more powerful group of humans; often the group that caused the organization to exist.

Hence, in this research:

A stakeholder is a role that a human or a non-human actor involved with an organization take on, whether that actor gains or looses value.

An actor is one of all humans and non-humans who may take on one or more stakeholder roles.

4.4.5 Micro- Sociology and Economics

4.4.5.1 Introduction

As summarized in Table 4-3 there are two topics searched in the literature presented in this section: the purpose and goals of organizations and business designs that are held to be true irrespective of the of a questioner's world-view on the profit-first to strong sustainability continuum.

4.4.5.2 Organizations: Purpose & Goals

Within the shared macro-social and economic purpose for human organizations introduced above (4.4.4) there appears to be no agreement at the ends of the continuum of world-views from profit-first to strongly sustainable:

- On the legitimate purpose and goals for an individual organization.
- Of what, where, for whom, for how long, and at what cost should any attempt at sustaining be directed.

4.4.5.3 Business Design

However, while there appears to be little agreement between the profit first and strongly sustainable world-views on the purpose and goals of organizations, there is considerable agreement on the reasons for and techniques to design businesses.

> *Why Model a Business?*
>
> The shared macro-social and economic purpose for human organizations introduced above (4.4.4) recognizes that for any human to choose to participate in an organization depends on the organization's efficiency and effectiveness and hence the 'net value' that could be derived by that individual (i.e. the outcomes they experience)[38]. Whether this condition exists depends on the design of the business within its stated purpose and goals.
>
> Irrespective of the specific purpose or goals (based on world-view), the broad processes by which the design of a business is undertaken is common. Further, within these common processes it is well recognized that time and effort spent planning (i.e. designing) may improve outcomes and the efficiency and effectiveness with which they are produced. Such design activities may make use of models to help conceive, record and reflect upon the desired future (for the reasons given in 4.4.2).
>
> Thus it is unsurprising that organization's, during their planning processes, should find it useful to create models of their existing and desired businesses. That a business model, which by word order alone implies the description of a complete business, might be useful is perhaps a little more surprising: the typical analytical approach being more interested in parts than wholes. Perhaps this is reflected in the relative novelty of the term and the recent up take in its use during the process of business design.

[38] Of course due to the aforesaid issues of power, an individual may have no choice in seeing value destroyed because more powerful individuals have caused an organization to exist.

A Brief History of the Concept of Business Models

The first mention of the term business model in the academic literature is in the context of designing a multi-stage, multi-person business game to be used for executive training purposes by the American Management Association. Here the whole business needed to be conceptualized to assist with the design of the game (Bellman, Clark, Malcolm, Craft, & Ricciardi, 1957, p.474).

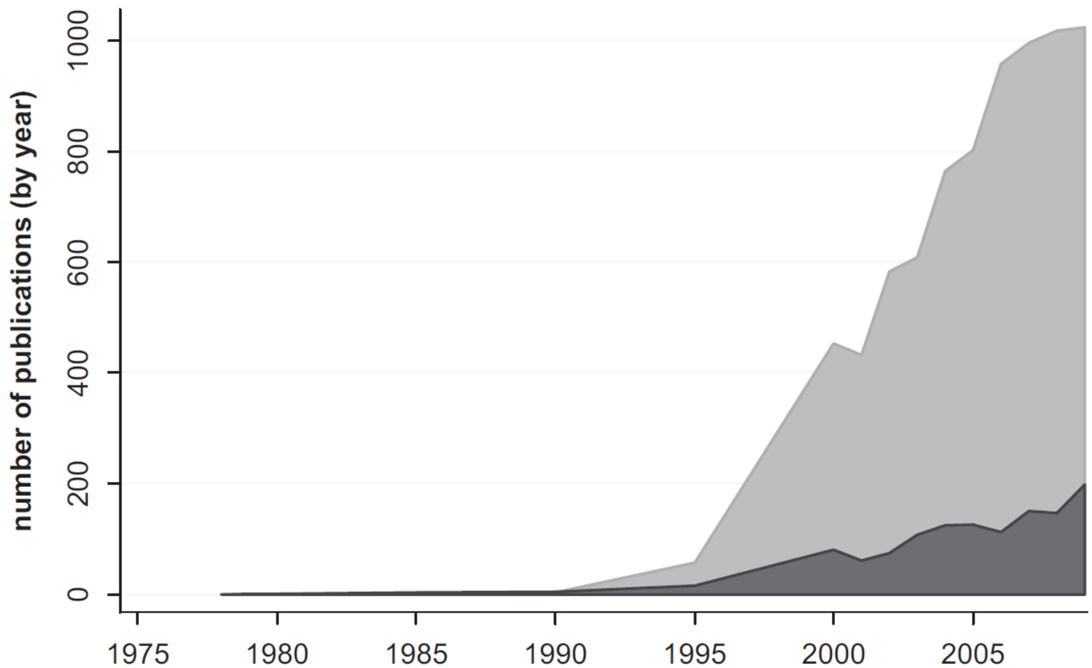
(Jones, 1960, p.626) also using the term in the context of business games states: "the big realization to be gained from management gaming is the balancing of all these ideas [marketing, accounting, production, finance, investment, etc. …]. During the business student's academic career he should have the same balancing experience, dealing with a […] business model."

As shown in Figure 4-6, in their 2011 systematic review of the business model literature Zott et. al. found the use of the term "business model" started in the late 1970's in both the academic and the practitioner business press. They state: "the business model has been the focus of substantial attention from both academics and practitioners. Since 1995 there have been at least 1,177 articles published in the peer-reviewed academic journals in which the notion of a business model is addressed". Based on salience to defining the concept of a business model Zott et. al. conducted a study using 103 of these articles (and books)[39].

There appears to be general agreement that the term 'business model' came into use due to the move of large numbers of computer science graduates, highly trained in abstraction, modelling and design, into businesses whose success depended on digital networks, such as the internet. In turn these new businesses challenged many existing industries at a fundamental level (the favoured term of the early-mid-1990's was 'dis-intermediation') (Osterwalder & Pigneur, 2005, p.4; Stähler, 2002a, p.4; Zott, Amit, & Massa, 2011a, Fig.1 p.5). Zott et. al. noted "The research stream that, to date, has

[39] Zott et. al. appear to have included results from earlier similar literature reviews, for example Shafer et al 's 2005 article "The power of business models" (Shafer, Smith, & Linder, 2005).

devoted the greatest attention to business models concerns e-business. The term e-business means 'doing business electronically' " (Zott, Amit, & Massa, 2011a, p.5).



Light grey = articles published in non-academic journals;
Dark grey = articles published in academic journals;
Source: Business Source Complete, EBSCOhost database, January 1975–December 2009.

Figure 4-6: Business Model Articles Published Per Year in the Academic and Practitioner Business Press
(Zott, Amit, & Massa, 2011a, Fig.1 p.5)

Processes of globalization (increasing international trade in goods and services aka outsourcing / contract manufacturing), enabled by the same technologies, further challenged the previously normal practices of whole industries. Together, these fundamental challenges to the profit-first defined viability of whole industrial sectors and even national economies, recommended gaining a broad understanding of networks of businesses and whole organizations within those networks (Chesbrough & Rosenbloom, 2002, pp.532-533; Kagermann, Lay, & Moore, 2008; Tapscott, 2000).

From the academic perspective Chesborough undertook to identify the "antecedents to the business model concept" in the scholarly literature of business strategy. To do this, he undertook a review of the literature from 1959-1997 of Penrose, Chandler, Ansoff, Mintzberg, Andrews, Teece, Prahalad and Silverman (Chesbrough & Rosenbloom, 2002). From this he argues that the business model concept may usefully inform earlier perspectives on why firm's have such a poor track record of "managing (technology) innovations that fall outside of their previous experience, where their earlier beliefs and practices do not apply" (p.531).

In 2002 Stähler successfully defended the first PhD which used the business model as the unit of analysis (Stähler, 2002b). In a translation of one chapter of his PhD, and somewhat contradicting Chesbrough's connection of technology enabled business innovation and business models, Stähler states: "the early connotation that a business model is related to information and communications technologies is lost today" and that "while in information management [a business model] refers to the model of an existing business, a business model can also be used to plan to design a new business" (Stähler, 2002a, p.4).

In 2005 Osterwalder and Pigneur continued to identify the lack of a common definition of a business model. They offered a maturity model for the evolution of the business model concept, shown in Figure 4-7. At the time they identified work in each of the first four stages which had appeared an appropriate chronological order. However, subsequently further work has appeared in all these categories, suggesting both that there is iteration occurring, and that considerable work remains for a common definition to emerge.

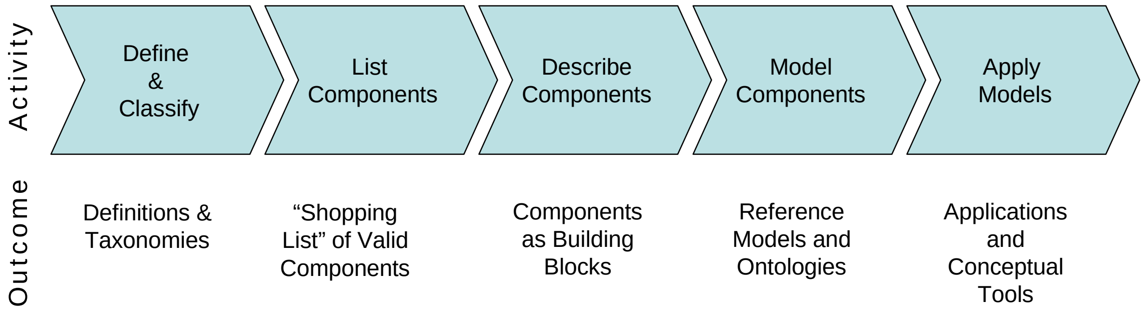


Figure 4-7: Evolution of the Business Model Concept
(Simplified from Osterwalder & Pigneur, 2005, Fig.3 p.6)

By 2010 it was well recognized that business strategy, innovation and business models were highly interconnected, albeit not without significant gaps of knowledge. Addressing these gaps was the focus of the 2010 special issue "on the concept of the business model" of Long Range Planning (Baden-Fuller et al., 2010). Articles explored: definitions of and approaches to construction of business models, how business models emerge in practice, creating "business models for emerging economies and social uses", and factors influencing the successful implementation of a desired business model.

In his contribution to the definition of business models Teece observes that "the study of business models is an interdisciplinary topic which has been neglected despite their obvious importance, it lacks an intellectual home in the social sciences or business studies" (Teece, 2010, p.176). Teece goes on: "the concept of a business model lacks theoretical grounding in economics or in business studies. Quite simply there is no established place in economic theory for business models; and there is not a single scientific paper in the mainstream economics journals that analyses or discusses business models". This he asserts is because general equilibrium models of neo-classical economics are a "caricature of the real world" and "the problems of capturing [monetary] value [the focus of business model design] is simply assumed away". He also asserts, without explanation, that business models "lack an acceptable place in organizational and strategic studies" (p. 175).

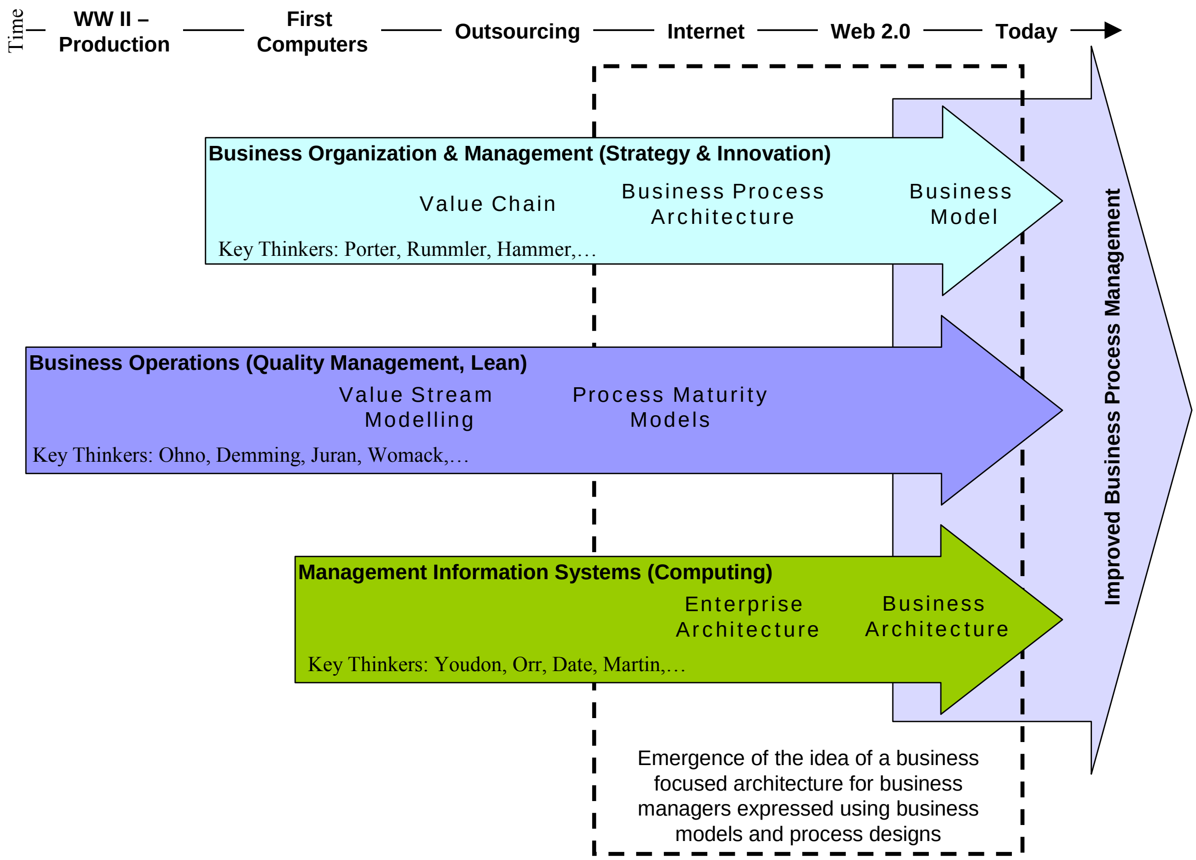
In a commentary on this special issue of Long Range Planning, Stähler observes that in his contribution Teece:

> *Forgot to mention that the concept [of business models] has foundations outside the little world of business strategy. The concept has foundations […] in information science where IT guys used (data) models to build enterprise IT. From there the data models were used more and more in strategy to describe what a business is and how it creates value. […] Business theory and economics should wonder if they use the right unit of analysis. [… A typical unit of analysis,] industry, is extremely dated […]. The concept of how you create value is core for looking at changes, and this is exactly what the business model describes.* (Stähler, 2012)

Aligned with this broader perspective, in 2010 respected practitioner Paul Harmon, of the think tank Business Process Trends (BPTrends)[40] identified how business models (as "architectures of business") fit within the historical development of a number of business, organization and information systems topics. These relate to the focus of BPTrends: improving the management (design, operation, improvement) of business processes – the commonly viewed universal mechanism for the creation (and destruction) of value for organizations' stakeholders.

More recently the information systems enterprise architecture movement has recognized the dependence of IT / MIS design on a solid understanding of business models (Goethals, 2009; Grigoriu, 2011).

[40] http://www.bptrends.com



Darkest bold type used for topics considered relevant to the emerging concern of business architectures and their relevance to improving business process management.

Figure 4-8: Three Process Traditions and an Emerging Concern
(Adapted from Harmon, 2010, Fig.9)

Despite the high level of interest, as of 2010-11, it is clear that in the academic literature no shared definition of a business model, nor its purpose, exists. Al-debei reports that the concept is "fuzzy" (Al-debei & Fitzgerald, 2009), Stähler, commenting on the special issue of Long Range Planning suggested that the academic work on business models is lagging behind the "real world" (Stähler, 2010) and Zott et. al. report, if anything, a divergence of definitions and conceptions or a simple disregard for definition (Zott, Amit, & Massa, 2011a, pp.4-5).

Zott et. al. summarizing the literature to that point, in their comprehensive review paper for the Journal of Management (backed with a 45 page detailed report), provided more detail on the theoretical roots of the business model concept. This included a comparison of business models to related concepts such as ecosystems, activity systems, value chains and value networks, as well as a summary of types (patterns) of business model designs (specifically related to e-businesses) (Zott, Amit, & Massa, 2011b).

However, overall Zott et. al. concluded that

> *The review reveals that scholars do not agree on what a business model is and that the literature is developing largely in silos, according to the phenomena of interest of the respective researchers. However, the authors also found emerging common themes among scholars of business models. Specifically, (1) the business model is emerging as a new unit of analysis; (2) business models emphasize a system-level, holistic approach to explaining how firms 'do business'; (3) firm activities play an important role in the various conceptualizations of business models that have been proposed; and (4) business models seek to explain how [monetary] value is created, not just how it is captured. These emerging themes could serve as catalysts for a more unified study of business models* (Zott, Amit, & Massa, 2011a, p.20).

In parallel with all this, scholars taking a systems perspective on management and organizations (introduced in 3.5.2.2) have enhanced aspects of the business model conception and of the process of business modelling (Costa & Cunha, 2009; Dawson, 2007; Normann & Ramirez, 1989; Normann, 2001; Zott & Amit, 2010)[41].

As of mid 2013, manual and digital tools derived from Osterwalder's work on business models are now in widespread use, enhancing the sketching, prototyping and simulation of business models during organizational planning (design) and management education (3.5.1.3).

[41] Albeit, all without thinking about the containing systems of human organizations other than the economic, i.e. broader society and the biosphere and not considered.

Finally in the past 12 years some academics and practitioners have started to consider how the concept of business models and business modelling might be applicable to, or might need to be adjusted to be applicable to firms seeking to achieve sustainability objectives. As might be expected some of these works are based on a profit first world-view as shaped via ecological modernization (Birkin, 2000; Darby & Jenkins, 2006; Griffiths & Petrick, 2001; Hall & Wagner, 2012; Kiron, Kruschwitz, Reeves, & Goh, 2013; Normann, 2001; Osterwalder & Pigneur, 2011; Seuring & Müller, 2008; Stubbs & Cocklin, 2008)[42], while others start from the strongly sustainable world-view (Bansal, 2011; Cavagnaro & Curiel, 2012; A. Clark, Rose, Richings, Gall, Peterson, Korycki, Hodges, Ridsdale, Upstone, Pollard, Aitken, Hiscock, Charlton, & Brown, 2009,2010,2011b; Hutchins, 2012a; Hutchins, 2012b; Hutchins, 2012c; Jansen, 2012; Laverdure & Conn, 2010; Osgood, 2009; Outhwaite, 2009; Parrish, 2010; Parsey & Topp, 2010; Schwaninger, 2008; Stead, Stead, & Starik, 2004; Willard, 2010a). Depending which stance a work takes, the content of these works will be reviewed as befits their world-view, in either the Profit First (4.5.5) or the Strongly Sustainable sections of this literature review (4.6.5).

A Brief History of the Use of Business Models

The preceding historical review focused on the history of the development of the concept of a model of entire businesses. But how has this concept been used in practice? How is the concept useful to academics and practitioners? Indeed, why do business models matter?

Answering this latter question in 2002, Magretta pointed to a link between business models and business's strategy. This she suggests is the business models ability to "tell a story" that explains "how all the pieces of the business fit together" and the critical role this plays to successfully explain, justify and subsequently operationalizing strategy (Magretta, 2002, p.87 & p.91). Without such a story she maintains, risk is high of stakeholders not having a (shared) understanding of such

[42] See also Osterwalder's dormant website http://www.businessmodelsbeyondprofit.com. It appears Osterwalder also helped to organize a conference in London, U.K., in 2009-2010 "Beyond Zero".

critical determinants of success as who is the customer, what they value, and how is that value is monetized.[43]

At around the same time, Chesbrough was one of the first to apply to business models an insight that arose from the Business Process Re-engineering movement (BPR): that "radical redesign" of business process can lead to "dramatic improvement" in competitive advantage (Hammer & Mangurian, 1987; Hammer, 1993). He realized that more innovative value propositions and business process designs (i.e. unusual based on the firms past experience) could be more easily conceived within the context of a re-imagined business model than without it (Chesbrough & Rosenbloom, 2002; Chesbrough, 2010)[44].

Talking specifically to the unfamiliar opportunities for business success that arise from technology inspired innovation, Chesborough argues that designing and implementing business models makes it more likely that firms will succeed in such situations (Chesbrough & Rosenbloom, 2002, p.532).

At the same time, in the process of defending his PhD research proposal, Osterwalder identified that business models, expressed rigorously using an ontology can be used as the basis for other artefacts of value to business and business designers. Figure 4-9 shows these artefacts. The Business Model Ontology (centre) and the Business Model Modeling Language (top left) were the focus of his PhD. His subsequent popular work has produced artefacts of the types identified on the right and bottom left (3.5.3.1).

[43] This connection is shown in Figure 3-9 and is acknowledged in the positioning of business (model) design between strategy and operations by groups such as the Business Architects Association (see Annotated Glossary).

[44] It appears all of these ideas rest (unacknowledged) on the ideas of socio-technical systems innovation; the work of Emery and Trist starting shortly after the 2nd World War (Trist, 1981a). Further, Chesbrough does not acknowledge the BPR movement's primary insight as an antecedent of his thinking.

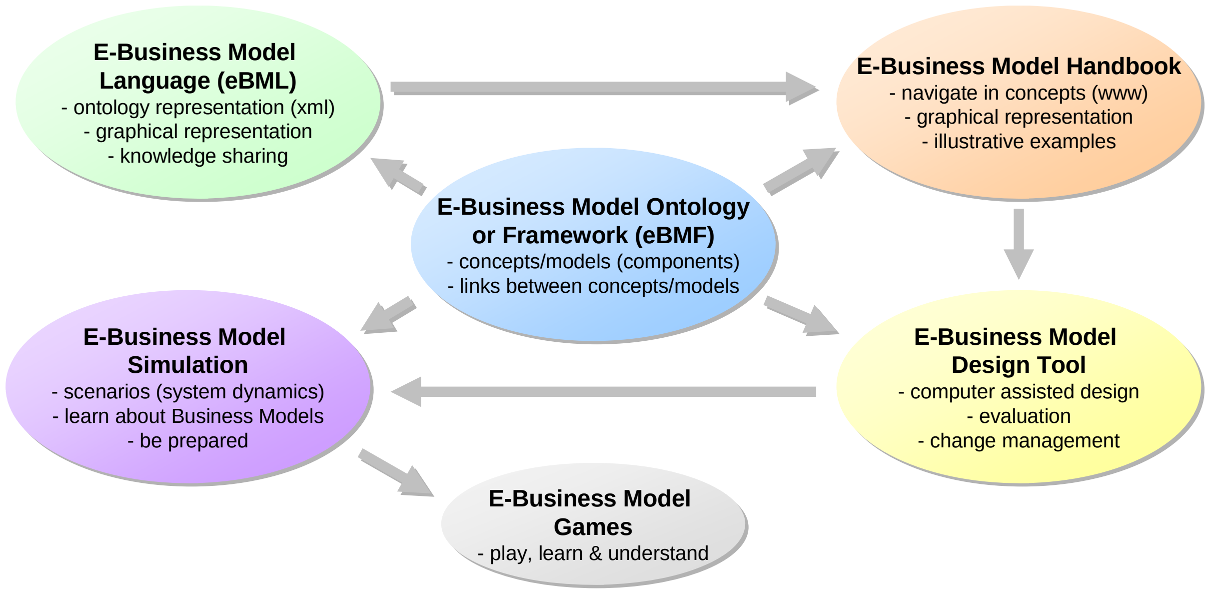


Figure 4-9: Subsequent Uses of an Business Model Ontology
(Osterwalder, 2002b, Slide 11)

By 2005, Osterwalder and Pigneur (Osterwalder & Pigneur, 2005), summarizing the literature to that point, state that there are five categories of benefits that may accrue to organizations that formally describe their business model:

1. ***Understanding and Sharing***: capturing description of current or desired state; visualization to aid handling complexity; gain improved understanding. All this enables improved communication and sharing with stakeholders from multiple backgrounds.

2. ***Analyzing***: measuring existing performance; track and observe change; compare between organizations or one organization's business models over time.

3. ***Managing***: improved design and designing; planning, changing and implementing; reacting to external change; alignment across business functions and units. All this enables improved decision making.

4. ***Prospecting***: innovating; preparedness for the future; prototype; simulation and test.

5. ***Patenting***: protection of business innovation.

This work goes on to offer supports to Harmon's perspective above (Harmon, 2010). Osterwalder and Pigneur review the benefits that may accrue through the use of business models in the management of digital information systems that enable improved business process management. Osterwalder and Pigneur identify four areas of likely benefit:

1. Enabling some or all of the five categories of benefits above with increasing efficiency and / or effectiveness

2. Improving the alignment and structure of business and information systems functions within organizations leading to improve requirements for and improved decision making concerning new and changed management information systems and their requisite infrastructures.

3. Improving the identification and design of indicators of organizational performance.

4. Enabling knowledge management strategies by providing an organization specific taxonomy for other organizational knowledge.

One of the few quantitative studies related to business financial performance and common patterns of business models appeared in 2006. Notable MIT Sloan system dynamicist Thomas Malone, the leading MIT Sloan IT Governance researcher Peter Weill and others asked: "Do Some Business Models Perform Better than Others". This longitudinal study classifies the business models of 10,970 publicly traded firms in the US economy from 1998 through 2002 into one of four business model types. These types were developed from the nature of asset rights sold (creators, distributers, landlords and brokers) and four variations of each based on the type of asset involved (financial, physical, intangible and human). They then analyze the financial performance in three categories: market value, profitability and operating efficiency.

They conclude: “no [business] model outperforms others on all dimensions. Surprisingly, however, we find that some models do, indeed, have better financial performance than others. For instance, Physical Creators (manufacturers) and Physical Landlords have greater cash flow on assets, and Intellectual Landlords have poorer Tobin Q ratio[45], than Physical Distributors (wholesaler/retailers). These findings are robust to a large number of robustness checks and alternative interpretations” (Lai, Weill, & Malone, 2006; Malone et al., 2006).

By 2007 groups such as the International Institute of Enterprise[46], a European think tank promoting entrepreneurship and innovation, was organizing workshops for “the European Business Model Innovation Forum”[47] advocating “the case for systematic business model innovation” (Daum, 2007). This was based on a 2005 Economist Intelligence Unit study of 4,000 executives and business leaders (sponsored by SAP AG). Summarizing the results, the top recommendation to enhance competitiveness was to “revisit your business model regularly. World-wide more respondents identify new business models as a greater source of competitive advantage than new products or services” (The Economist Intelligence Unit, 2005). This direction was confirmed by the 2006 iteration of this study of 765 business and public sector leaders (sponsored by IBM Global Business Services). This report devotes an entire section to business model innovation. The report quotes one study participant as saying “The business model we choose will determine the success or failure of our strategy” and finds that firms with faster growth in operating margins were also putting more emphasis on business model innovation (The Economist Intelligence Unit, 2006, p.12).

In 2009 Goethals builds on another insight that arose from the BRP movement: that a business’s processes can only be effective if they involved all necessary business functions / departments (Hammer & Mangurian, 1987; Hammer, 1993). Goethal’s

[45] Ratio of market value and replacement value of the same physical asset.
[46] http://www.iioe.eu
[47] http://www.iioe.eu/ebmif.html

observes that business models help conceive of a business as an integrated whole: "there is a need for comprehensive views on business models […]: It does not make sense to consider only a sub-part of the story [, as this is] just as likely to produce real and sustained performance losses as accidental improvements." (Goethals, 2009, pp.8-9).

This supported an earlier observation of Gordijin that "business modeling is not process modeling" but that business model design provides context for process design (Gordijn, Akkermans, & van Vliet, 2000). As a result, as Al-debei observes (pp.371-372), the use of business models, even tacitly, provide benefits to organizations by providing:

- A conceptual tool that enables improved alignment amongst internal departments and between internal and external stakeholders.
- Improved alignment of strategy and operations and hence increased likelihood of achieving strategic objectives.
- A store of knowledge related to the organization's design and design choices that is at a different level of granularity to either strategy or operations.

A quantitative longitudinal study of 45 organizations in a wide range of industrial sectors appeared in 2009. This sought to advise managers on whether factors conceptualized in their business model dynamically change their importance vis-à-vis business success depending on the phase of development of a firm (start-up vs. established) (de Reuver, Bouwman, & MacInnes, 2009). Their conclusion: "that when developing new services and products and their underlying business models, companies need to be aware of the role technology and market forces play in the first phase of business model development. Furthermore, design methodologies for business models that take into account their dynamics need to differentiate between start-ups and established firms" (p.10).

A second cross industry longitudinal study of 50 organizations in a similar wide range of industrial sectors also appeared in 2009 (Günzel & Wilker, 2009; Günzel & Wilker, 2012). This study sought to identify patterns of business models that lead to longer term success (with a specific focus on job creation) and whether these patterns are hetro- or homo-genous as an individual firm develops (startup vs. established) and between firms in different industries. Their conclusion, in addition to developing a framework for the identification and analysis of business models, identified that firms with a goal of scaling are more successful at doing so if they adopt a business model pattern which is inherently "fit for scaling". The alternative, changing their business model after launch to achieve scale was found to be less successful (pp.9-10).

Introducing the business model as the unit of analysis for his 2010 PhD Al-Debei concurs with the observations of Goethals and Daum. First he identifies the benefits for mobile communications businesses of considering the design of their business model within which their products and services are conceived, marketed, sold, delivered, serviced and paid-for. Citing others, he states: "the business model is considered to be the primary reason behind the success or failure of mobile and other information, communications and technology services and applications" (Al-debei, 2010, p.14). He goes on to observe that unlike product / service innovation and technology innovation, business models have more dimensions of potential innovation. Further one type of innovation may require another in order to be successful (p.16). Secondly, in a scholarly article published concurrently, Al-Debei and Avison conclude from their review of the literature that business models are different from but necessarily link business strategy and business processes (and their enabling technologies) (Al-debei & Avison, 2010, p.370).

Also in 2010 Clark, a collaborator of Osterwalder, completed a PhD entitled "cultural coloring", using the business model as his unit of analysis to explore "how national origin affects the international portability of business models". This work is an early example of a perceived connection between culture and the success (or failure) of business models. Concluding his research Clark suggests: all business models are coloured by their authors (national) culture. Further, based on his case studies, this colouring can have a material impact on business success, and hence evaluating the implications of culture on business model design is a valuable activity (T. J. Clark, 2010).

For their 2011~700 page book “Applying Real-World Business Process Management in an SAP Environment” the editors considered business models so critical for practitioners that they open with a 31 page chapter entitled “The Importance of a Business Model” (Chase et al., 2011, pp.23-54). This chapter opens with a review of two antecedents believed by academic researchers to explain the difference in overall performance between organizations: the industry view (market size, barriers to entry etc.) and the firm view (competencies, capabilities). However, reporting on empirical research, the chapter suggests these antecedents individually explain at best around half the variance in actual firm financial performance, with perhaps the weight being as a result of the firm view. Citing Malone et. al.’s study (Lai et al., 2006; Malone et al., 2006, discussed above) and other qualitative studies (The Economist Intelligence Unit, 2005; The Economist Intelligence Unit, 2006) these authors suggest that a better unit of analysis and hence better predictor of firm success is the business model. This is because, in their view, this allows an integration of the industry and firm views (von Scheel, Rosenberg, & von Rosing, 2011, pp.52-53). In short the business model perspective is helpful in innovating and transforming business to enable them to survive and thrive (monetarily):

> *Working with one business model helps a company maintain focus on core competitiveness and core differentiation while keeping a comparative advantage with the non-core competencies. Periodic reviews and updates [of / to the business model] help keep the business model relevant to current competition, market changes, economic conditions, and consumer demands.* (von Scheel et al., 2011, p.53)

In the same year, summarizing the literature to that point, Zott et. al. write that the purpose of business models is to:

> *To offer typologies or taxonomies [and] to explain new network and activity systems based value creation mechanisms and sources of competitive advantage* (Zott, Amit, & Massa, 2011a, Table 3 p.17)

Also in 2011 Spector asked how the Theory of Constraints (Goldratt, 1986; Goldratt, 1997) could be used to improve business operational performance when the constraint was some factor related to the business model. By looking for and resolving constraints in the business model "enables managers to analyse and control the most important factors in the firm […] in new ways" (Spector, 2011, p.3393).

As noted in 2.1, by 2011 practitioners were identifying the quality (reliability, consistency, and effectiveness) of business models and the efficiency business model designers as a problem that was impacting business and overall macro-economic performance. Practitioners suggested that the typical failure rates for businesses (their business models and hence their business model designers) would be an unacceptable result of a design process in any other area of business (Osterwalder, 2011, slide 19 [minute 3.00-3.30]).

Inspired by common practice, believed to enhance efficiency and effectiveness in other fields of design, this observation invigorated interest in tools to help business model designers evaluate many (alternatives) through sketching, prototyping and simulating. This lead teachers and practitioners, such as innovation and entrepreneurship specialists Steve Blank and Eric Ries, to start to teach and practice business model design and the process of designing business models using techniques from other fields of design. These activities include as a key component the recognition of the value and hence the adoption of design tools such as Osterwalder's Business Model Canvas (Hobcraft, 2012).

By 2012 practitioners were agreed that putting the business model concept to use was highly valuable. One summarized as follows: "what's this business model thing? 1. It's a concept: it lasts forever; 2. It's a language: for communication; 3. It's a method: for innovation" (Donelli & Hugowiz SAS, 2012).

Finally in the past 8 years academics and practitioners have started to consider how the concept of business models and business modelling might be useful in helping firms seeking to achieve sustainability objectives. As might be expected some of these works are based on a profit-first world-view as shaped via ecological modernization (Birkin, Cashman, Koh, & Liu, 2009; Birkin, Polesie, & Lewis, 2009; Boons & Lüdeke-Freund, 2012; Colbert, Kurucz, & Wheeler, 2008; Kiron et al., 2013; Melaragno, 2010; Yunus, Moingeon, & Lehmann-Ortega, 2010), while others start from the strongly sustainable world-view (Cavagnaro, 2007; A. Clark, Rose, Richings, Gall, Peterson, Korycki, Hodges, Ridsdale, Upstone, Pollard, Aitken, Hiscock, Charlton, & Brown, 2009,2010,2011b; Colby, 2011; Jansen, 2012; Laverdure & Conn, 2010; Outhwaite, 2009; Parsey & Topp, 2010; Stead et al., 2004). Depending on whether each work is taking a profit-first or strongly sustainable stance, the content of these works will be reviewed as befits their world-view, in either the Profit First (4.5.5) or the Strongly Sustainable sections of this literature review (4.6.5).

Concluding on the Shared World View of Business Design

This concludes the historical review of the aspects of the literature on business design which are shared between scholars and practitioners holding the profit-first and strongly sustainable world-views.

Summarizing: both groups consider the business model concept and the process of designing business models valuable to:

- Managers to help establish and maintain successful businesses over time
- Scholars to help to understand the antecedents of business success over time

However, this means the many aspects of these works have an explicit connection between the underlying world-view and the definition, construction or utility of the business model construct, and hence are **not** shared. These divergent aspects are reviewed below. As befits the world-view of the work, the review is placed in either the Profit First (4.5.5) or the Strongly Sustainable sections of this literature review (4.6.5).

4.4.6 Shared Business Model Ontology Detailed Design Principles

The literature which takes a neo-classical or ecological world-view of business models has yet to be reviewed. However, the results of the traditional literature review presented in Chapter 3 and the shared world-view, presented above, supports a working definition of a business model (introduced in 3.5.1.4 and 3.5.1.5) and its boundaries (introduced in 3.5.3.4 and refined in 3.5.4.4, 3.5.4.8 and 3.6.7).

Integrating this with the literature above, ODP1 (basing the ontology on the latest natural science) and ODP2 (taking an empathetic stance towards its users and hence the need to be able to describe business models based on either world-view) enables the first detailed design principles to be identified.

Further support for these design principles is provided by the literature reviewed under the profit first and strongly sustainable world-views below. However, it is suggested that the works reviewed above are sufficient to (perhaps minimally) justify these design principles.

DDP1: Diagrammatic Formalism

The SSBMO will be expressed using a proven formalism that enables the description of its structure and of instantiations. This will have both a semi-formal textual and formalized visual representation.

The SSBMC will be expressed in a visually attractive diagram, derived from the SSBMO diagrammatic formalism.

DDP2: Conception of a Business Model

The SSBMO will describe the relationships between the following, which collectively define a business model:

- Ensuring the 'right' things to do are known:
  - For whom the organization exist (who defines and wants the value the organization creates, who benefits and how) (i.e. who does the organization do it for – its stakeholders)?
  - Who the organization impacts (positively or negatively from the impactees perspective, creating or destroying value) (i.e. to whom does the organization do it – its stakeholders)?
  - Who the organization involves in the on-going processes which are required for it to create the value (i.e. with whom does the organization do it – its stakeholders)?
  - What the organization does to create or destroy value (i.e. how does the organization describe its positive and negative value to its stakeholders – its value propositions)?
- Determine how the 'right' things are to be done 'right' now and in the future
  - How the organization acts to create the value, including where things are done and decision making processes about any and all aspects of the business model (i.e. processes)?
- Ensure whether the 'right' things are being done 'right' is known
  - How the organization defines success, how is this success (or failure) measured and declared?

In summary the SSBMO will provide the capability to describe a strongly sustainable business model, defined as:

> A description of the logic for an organization's existence:
> Who it does it for, to and with;
> What it does now and the future;
> How, where and with what does it do it; and
> How it defines and measures its success.

i.e. the SSBMO allows:

> A description of how an organization defines and achieves success over time.

DDP3: Conceptions of Boundaries

The SSBMO will describe the relationships between the following, which collectively define the boundaries of a firm's business model:

- ***The social definition of a firm's boundary*** based on the agreement of the firm's purposes made by the firm's stakeholders who have, gain or are granted sufficient power in the decision making process. The agreed purpose is based on the value the firm will create (and destroy) for the stakeholders. This is achieved through the delivery of satisfiers that meet (or fail to meet) a sub-set of the stakeholder's fundamental human needs.
- ***The legal definition of a firm's boundary*** based on the concept of 'ownership' and the concept of the firm as a "legal person" (with the rights and obligations this entails).
- ***The systems outside a firm's boundary*** based on the system of systems of which a firm is a part (including all stakeholders: other firms, networks of firms, communities; the biophysical environment; and the human constructed social and monetary domains).

- ***The systems within a firm's boundary*** containing a firm's business processes which create (and destroy) stakeholder value through interactions with the containing systems.
- ***The conceptual (knowledge), social (relationships) and 'objective' (physical) artefacts inside a firm's boundary*** are those that need to be 'owned' or 'controlled' for its processes to create (and destroy) stakeholder value (broadly the firms capabilities and resources).
- ***The social (relationships), physical and conceptual artefacts which are 'shared' with other social constructs via the containing systems.*** These are described in (formal) agreements with stakeholders, and are realized in various types of flows: monetary flows with stakeholders (investments, revenues, payments, interest, and dividends), bio-physical material flows to and from bio-physical stocks and eco-system services, as well as energy flows to and from the biosphere.

DDP4: Timeframe for Validity

To be useful SSBMO will consider the natural science requirements for sustainability of current life as they may be understood in as long a time period as feasible. Short term or conceptions which may change should be avoided, unless no long term conception is indicated by the natural science.

Explanation: The effort required to close the gap between current conceptions of flourishing and existing conditions is large, and hence time consuming. As noted there are multiple balancing loops acting to reduce and slow changes to close this gap. Long term modelling of scenarios for global change that acknowledges the ultimate biophysical limits suggests 30-100 year time frames are not unrealistic (MacKenzie, 2012; Meadows, 2005; Turner, 2008). Any conception of a business model which does not attempt to include the elements necessary to model such a long term view is likely to be of limited (ultimate) utility to enabling strongly sustainable outcomes. Of course, if such concepts are not currently well recognized, this could limit acceptance.

4.5 The Profit-First World-View (K0-PF)

4.5.1 Introduction

This section presents knowledge of the problem and solution domains that appear to be held as valid by scholars who take the neo-classical stance to business models (and relevant topics) but that would not be found valid by scholars who take the strongly sustainable stance.

The description of this world-view is at its most extreme point on the continuum of profit-first to strongly sustainable. This is not to indicate that in practice many people hold, let alone act upon, the position as stated. As illustration of this acknowledged reality one or two 'less extreme' examples are provided to aid interpretation and application.

4.5.2 Formal Sciences

The formal science knowledge relevant to this research is not changed by the profit-first world-view. This knowledge was described in 4.4.2.

4.5.3 Natural Sciences

4.5.3.1 Introduction

As summarized in Table 4-3 there are three topics searched in the literature presented in this section: the perspectives on sustainability and flourishing, human world views, and human and non-human needs and satisfiers that are held to be true by questioner's who hold the profit first world-view.

4.5.3.2 Sustainability and Flourishing

As noted by its inclusion in the shared world-view (4.4.3), there is little of practical significance to business models in the natural science knowledge of sustainability and flourishing with which profit first scholars would disagree.

4.5.3.3 Human World-Views

However, while they might not contest the science, people holding the profit-first would most certainly argue its relevance to business. In other words, parts of these individual's world-views unrelated to the nature and purpose of human organizations, may cause some or all of the natural science knowledge of sustainability and flourishing to be considered irrelevant to business.

As one example: Ackoff describes a world-view which would cause rejection of the applicability of the natural science of sustainability and flourishing presented in 4.4.3.2 (Ackoff, 1974)[48].

Ackoff suggests a world-view grounded in the "Machine Age" requires a first cause to be identified, and that a common resolution of that need is in conceptions of God. Explicating: the Machine Age understanding of reality is that the world **is** a machine ("a hermetically sealed clock": self contained, not contained in anything else, a closed mechanism). Hence, in this world-view God is external to the world which He created. Since to do the will of God man was made in His image, man is more like God than anything else on earth. This suggests that man should invent more machines (physical and social technology) to further God's work.

Such a world view enables the following beliefs[49]:

- Human development, aka progress[50], is teleological and a 'right'
- Humans have a privileged position in regards to other life, access to and use of any part of the biosphere and lithosphere.
- Humans with the most most advanced technologies are in a privileged position in regards to other humans and other life.

[48] See also the lectures on this topic (University of Pennsylvania Arts and Sciences Organizational Dynamics, 1980-2010)
[49] In addition to Ackoff's analysis this list was also constructed by reversing the strongly sustainable world-view position described in 4.6.3.3.
[50] As per "A Short History of Progress" (Wright, 2004).

- Human technologies may be created, used and discarded without limit to ensure the flourishing of the most privileged living humans.
- Human's have limited biophysical responsibilities.

In turn this example world-view and attendant beliefs could logically cause the believer to reject most of the natural science knowledge on sustainability and flourishing as invalid to business.

These beliefs appear compatible with the profit-first conception the purpose of firms defined below (4.5.5); they are far harder to reconcile with strongly-sustainable conceptions (4.6.5).

None of this, as noted above, is to suggest that anyone who sees value in the profit-first purpose of business necessarily holds all or any of these underlying beliefs.

4.5.3.4 Human and non-Human Needs and Satisfiers

While the human needs identified above (4.4.3.4) are thought to be universal, their satisfiers are known to be variable[51].

An example which perhaps has some relevance to which satisfiers people holding the profit first world-view would consider more or less valuable is provided by Haidt. Reporting on the latest neuroscience research concerning how moral concerns influences belief, he provides concrete examples of how world-views influence values and hence perception of value. Figure 4-10 shows how persons with differing stances to social change (conservative and progressive) determine whether value is created or destroyed by various satisfiers (based on the relative importance they place on six moral concerns).

Based on this research value is created by satisfiers that do not overly prioritize one moral concern over another for persons identifying as conservative, where as for persons identifying as progressives, value is created by satisfiers that prioritize care, liberty and fairness.

[51] Acknowledged in the working definitions of value creation and value destruction, 4.4.3.5.

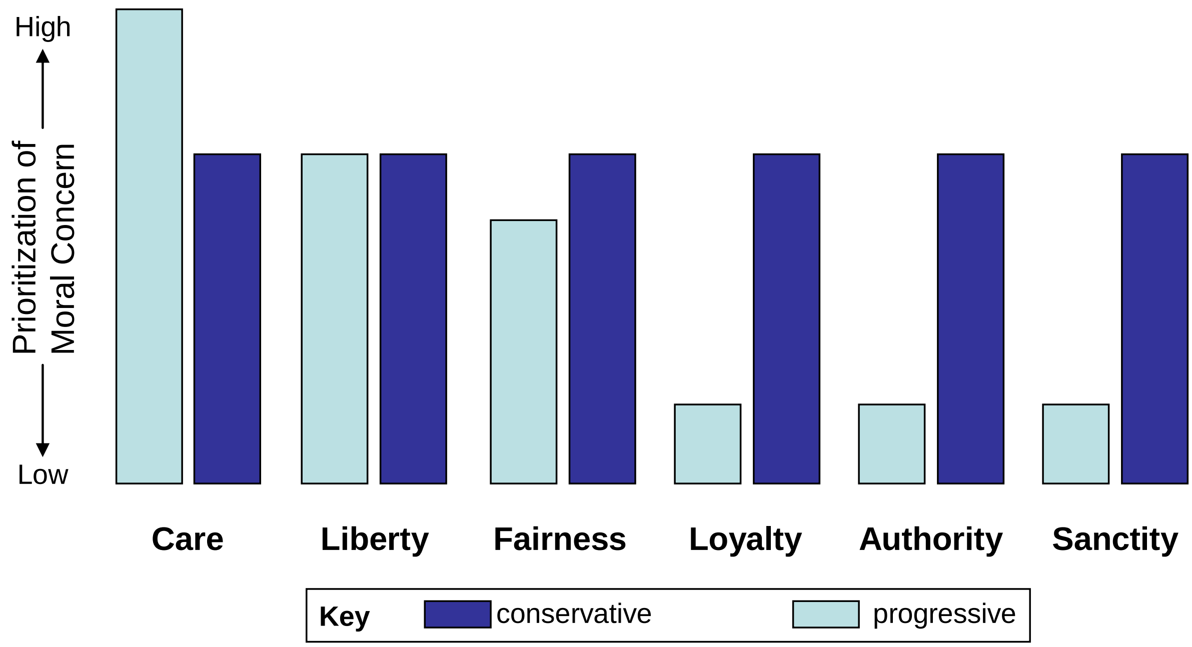


Figure 4-10: Prioritizing Six Moral Concerns[52]
(Haidt, 2012)

This suggests that the profit-first vs. strongly sustainable world view may influence the value individuals perceive they receive from the same satisfier. Since it is conceivable that the profit-first world-view is somewhat aligned with Haidt's definition of 'conservative' and the strongly sustainable world-view is somewhat aligned with Haidt's definition of 'progressive' this perspective may be of use when understanding practical similarities and differences between the world-views.

4.5.4 Neo-Classical Macro- Sociology and Economics: Human Social Goals

As summarized in Table 4-3 there is one topic searched in the literature presented in this section: what, if any, goals for society exist if the questioner's world-view is profit first?

If the universal human needs are uncontroversial (4.4.3.4) and the overall goal of human society, to attempt to meet universal human needs, is also uncontroversial (4.4.4), then what might vary based on difference in the world-views? Since value is defined as the interaction of satisfiers and world-view, what might vary, is agreement over what value should be maximized and which satisfiers should be used to create this value.

[52] See also this interview of Jonathan Haidt by Bill Moyer (Moyers, 2012, minute 18.34)

The last time that there were significant discussions in the Global North about the satisfiers to maximize the achievement of human needs was in the period starting with The Great Depression of the 1930s and ending in the years following the 2nd world war. The result was a broad consensus of economists that crossed the political spectrum: maximizing GDP growth (and hence per capita income) via 'full' employment within a democratically regulated system of capitalism and international trade was seen to be the best satisfier to achieve the most human flourishing most quickly (Ormerod, 1995, ch.3 "Roots of Economic Orthodoxy", pp.38-66; Victor, 2008, pp.4-14).

Neo-classical economists (i.e. the current main stream majority), argue that this approach, based broadly on models of the economy consisting only of firms and households, remains both necessary and sufficient for human flourishing.

In light of the rise of environmental concerns in the Global North in the 1960's and early 1970's (Edwards, 2005) neo-classical sociologists developed a very hopeful sociological theory known as ecological modernization (Mol & Spaargaren, 1993; Mol & Spaargaren, 2006). This explained how the GDP growth approach to enabling flourishing may do so without risk to the biosphere's ability to support current life. This approach is often labeled 'eco-efficiency' since it is significantly based on the believed inevitable ability for (new) human technologies to continuously enable more satisfiers for more needs while using in total less (natural) resources. This path is asserted to ultimately enable flourishing for humanity within any (biophysical) limits that may exist.

In the macro-economic sphere similar concerns were taken up within the broad paradigm of the neo-classical approach. This has lead to the development of the similarly optimistic fields of natural resource and environmental macro-economics (Røpke, 2004).

As noted in 3.5.3.1 and 3.5.3.2 the combination of these ideas may be found in conceptions of 'sustainable development' (WCED, 1987) and are labeled "weakly sustainable" by ecological economists (Ayres, van den Bergh, & Gowdy, 1998; Ayres, 2008; Neumayer, 2010).

4.5.5 Neo-Classical Micro- Sociology and Economics

4.5.5.1 Introduction

As summarized in Table 4-3 there are two topics searched in the literature presented in this section: the purpose and goals of organizations and business design that are held to be true by questioner's who hold the profit first world-view.

4.5.5.2 Organizations: Purpose & Goals

Within the macro-sociological and economic mechanisms described above for creating human flourishing (4.5.4), amongst neo-classical economists holding the profit-first world-view, there appears to be consensus of the underlying purpose of a business. This was perhaps first and best articulated by Friedman as follows:

> *There is one and only one social responsibility of business – to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of the game, which is to say, engages in open and free competition without deception or fraud.* (M. Friedman, 1962, p.133).

As an example of the monistic (and hence extreme) nature of this statement, perhaps starting with Peter Drucker's inquiry into the purpose of business in the 1950's (Drucker, 1954, pp.34-48), it is now commonly recognised by organization and management scholars that the singular pursuit of profit implied by Friedman is unlikely to lead to sustained monetary solvency, let alone profitability.

Writing in the late 1980's Normann and Ramirez observed that it is an increasingly difficult task to separate products, services and information (i.e. as a result of outsourcing, the servicization of manufacturing enabled by improved information systems). They proposed that to be successful a firm needed to make an 'offering' consisting of a "product-service-information mix defined at a given price". This they assert holds for any type of business, and includes existing and new assets required to remain solvent over time (Normann & Ramirez, 1989, p.112).

By 1996 Hammer, one of the founders of the BPR movement, likely inspired in part by Drucker and Normann & Ramirez, in a popular book on business innovation, was able to make the following assertions without risk of widespread ridicule:

> *Generating profits in order to pay for [its] capital is not the essence of a business nor is it its mission. It is only one of its requirement.* (Hammer, 1996, p.101).
>
> *[Hence] Customers are people whose behaviour the company wishes to influence by providing them with value* (p.97).
>
> *[And therefore,] the mission of a business is to create value for its customers [… i.e. create] a solution to a customer's problem [... by doing] whatever it takes to answer a customer needs* (p.98).

This suggests that any business strictly following Friedman's objective is likely to focus on being monetarily efficient (and hence highly profitable) while ignoring the need to effectively produce outcomes of value to their (ultimately paying) stakeholders. As Hammer implies, no business, even one claiming a primary concern for profit maximization, adopting such an approach will survive for long.

Since the mid-1990's this view of the purpose and goals of business has not been static. A powerful force for changing the purpose and goals of business has been created by a large number of inter-related and inter-acting factors:

- Development of theories of ecological modernization, natural resource and environmental economics
- Natural science reports of on-going damage to the biosphere caused by business
- Resultant social disquiet, and finally
- Increases in environmental regulations and environmental taxes.

But despite the undoubted power of these factors, has the broad profit-first conception of the purpose and goals of a firm actually changed?

In the past 20-25 years an increasing number of businesses have taken, and continue to take, action related to what neo-classical economics refers to as (monetary) ‘externalities’. However, in most cases, as reported by academic study (reviewed below), the innovations related to these actions have enabled firms to retain or accrue additional monetary profit or other additional economic benefits.

In other words the basic profit-first purpose and goal of the firm remains unchanged: these activities simply represent the latest wave of activity focused on maximizing monetary value through improved efficiency. All that appears different is the sphere that inspires the innovation, and to which some non-financial value may accrue (i.e. the biophysical environment and / or less frequently broader society). This further explains the wide range of labels, usually without formal definition, given to these activities (summarized in 3.4.6.1).

As examples of this trend:

First: A qualitative study of 66 business leaders conducted in the middle of the first decade of the 21st century at three large Canadian-based entities identified a number of conceptions of “triple bottom line business sustainability” (Colbert & Kurucz, 2007). These ranged from conceptions that business sustainability is:

- Trade-off management: “a set of economic, social and environmental risks to be managed and mitigated […] to manage the inevitable tradeoffs [between stakeholders] that need to occur” (p.24)
- Win-win management: “strive for simultaneous value creation for all organizational stakeholders […] that would contribute to the firm’s [monetary] competitive advantage” (p.24).
- Win-win leadership: “create value broadly for society – to sense out the critical global issues, and then bring the organization’s capacity to bear to help solve those problems, at the same time creating [monetary] value for the company” (p.24).

Second: A 2010 comparison of one of the earlier works emerging from ecological modernization theory (Hawken, 2010, first published 1993) with what the authors refer to as, "New Corporate Environmentalism" (Forbes & Jermier, 2010). In their conclusion, entitled "how far can we go with green capitalism" these authors asked "If capitalist firms and the overall economy, green and otherwise, must 'grow or die', the important question is: can this be accomplished without continuing to undermine the natural environment, human health and happiness, and the prospects of future generations?" Other than the implicit rejection of the known biophysical limits to such endless growth (4.4.3.2), these authors (again implicitly) go on to reject business responsibility in answering this question by shifting the burden of action onto the electorate to ensure government takes the necessary actions to "steer capitalism in more benign directions" (p.478).

Third: A 17 year study of 180 companies, completed in 2010, compared firm's financial performance (stock price, return on assets and return on equity). The study asked the question "is sustainability something a company can always have more of, or, at a certain point, does the [monetary] cost of sustainable business practices outweigh their benefits". Half the firms "had long ago [voluntarily] adopted corporate policies regarding commitments to enhance social and environmental performance" and the remainder had not. The result: an equally weighted portfolio of stocks of the firms with a commitment to the environment had grown 22% more than the firms with no commitment to the environment (The equivalent value weighted portfolio had grown 47% more). Similar results were found for the measures return-on-assets and return-on-equity. The study concluded that there would continue to be (implicitly) acceptable externalities due to the monetary cost of addressing all of them completely, but that the level of acceptable externality was falling "due to three inter-related reasons: (1) new government regulations, (2) changing social expectations, and (3) innovation" (Eccles, Ioanno, & Serafeim, 2012a; Eccles, Ioanno, & Serafeim, 2012b).

Fourth: A 2008 monograph arising from the European Union funded Sustainable Consumption Research Exchanges (SCORE!) focused on a goal adopted in at the 2002 Johanneburg World Summit on Sustainable Development: Sustainable Consumption and Production (Tukker, Chater, Vezzoli, Stø, & Andersen, 2008). This work recognizes a broader set of knowledge is required for sustainability projects, bringing together business development, solution design, consumer behaviour and system innovation policy experts.

The academic research collected in this volume is leading edge, touching on subjects such as design, adaptive foresight, integrated socio-ecological approaches, and radical systemic change in both consumption and production. Much of the content focused on the business model changes required to enable sustainable consumption and production. But almost without exception the (unstated) assumption behind all the research is that (new) technology would solve problems related to total amounts of resources and energy consumed.

These examples show that conceptions of the purpose and goal of business have clearly shifted from Friedman's simplistic profit above everything else; further this shift has possibly begun for the majority of business people[53]. However, despite this apparent shift in thinking, what is also clear from these examples is, as Canadian political philosopher Blattberg asserts, that nothing has really changed: the basic premise of the profit-first world-view remains unassailed:

> *If doling out some of the corporation's short-term profits to various stakeholders contributes to its long-term [monetary] profits, then the question arises: is it really right to say that the corporation has forgone some of its [monetary] profits in order to meet the needs of non-shareholding stakeholders? For has not it just sacrificed some of its short-term gain for long-term benefit, that is, has not it, for strictly instrumental reasons, simply made an investment?* (Blattberg, 2000, p.175)

[53] Examples: First: In 2010 following direction from their CEO Wal-mart issued a 15 question survey to 100,000 suppliers to establish their "supplier sustainability index". This includes questions under the headings of energy and climate, material efficiency, natural resources, people and community. This action triggered their largest suppliers to follow suit such that a very significant fraction of businesses world-wide have or will be answering similar questions (Willard, 2012, p.40 & Fig.2.2 p.41). Second: in 2009 CEO of GE stated that what he believed big business would "most like, […] would be for the President to stand-up and say: 'by 2025 we are going to produce this much [electricity from] coal, natural gas, wind, solar, and nuclear [power] and nothing is going to stand in the way'. You'd have about three days of complaining and crying, and then people across the whole energy industry would stand-up and say 'Thank-you Mr. President, now let's go do it.' And we would go out and do it," (T. L. Friedman, 2008, p.430).

To reinforce this point: Tyler Elm, Vice President, Business Sustainability, stated in his comments on a 2012 business book about the (financial) case for sustainability initiatives in business:

> *Milton Friedman's edict […] is just as true now as it ever was. Yet […] what has changed is the context within which businesses operates, and thus how one bounds this edict in the pursuit of sustainable capitalism* (In advanced praise for Willard, 2012).

Some scholars, such as Eccles (above), and Laszlo and Zhexembayeva in their 2011 book (Laszlo, 2011) argue (with conviction, evidence and somewhat convincingly) that the changing social expectations of business will lead to a 'reset' of the purpose of for-profit business. In turn this will result a return to the understood historical purpose of business: the integration of shareholder or owner value, solution provision, end benefits and outcomes. In this situation, the authors argue, the generation of profit will not be possible if externalities are generated. So to remain in business companies will be required to be environmentally, socially and monetarily sustainable (pp.30-51)[54].

These profit-first authors collectively express the ultimate expectation (wish) of the ecological modernists: if their imagined world comes to pass it is will have higher levels of environmental, social and economic flourishing than today.

However, collectively these micro-social and economic works do not appear to address how their technologic approach will address key macro-social, economic and natural science biospheric issues i.e. total demand for goods and services based on total population and ultimate bio-physical global limits.

[54] Laszlo and Zhexembayeva, both business school scholars, paint a convincing picture of future business in this work tackling not only the what but the how. However, in both the title of their book claiming "embedded sustainability: the next big competitive advantage" and in a closing chapter it is clear the profit-first world view is still dominant. In the chapter "The world in 2041: A job interview", to illustrate what it might be like to work in this future world, they imagine a job interview for a senior management position in 2041. In this, from the description of the technologies used to get to the interview to the content of the discussion it is clear that while they believe many social expectations have significantly changed it is still fundamentally technology which enables profit while doing less harm. They do not appear to envisage a change in world-view which is focused on 'doing good while doing well' (Laszlo, 2011, pp.192-206).

As introduced earlier (3.5.3.1 Introduction to Strong vs. Weak Sustainability), this technologic profit-first view of the future, and the path to be taken to get there, has a certain risk profile for humanities survival, let alone flourishing. The profit-first risk profile is materially different and divergent from the risk profile of the strongly sustainable view. The different understanding of the risks is a key driver for the different purpose and goals of organizations held to be required by the strongly sustainable world-view. The strongly sustainable perspective on the goal and purpose of the firm is described in 4.6.5.2.

All the above are important context to the design (and use) of the SSBMO, since it is attempting not to be prescriptive (ODP2). Hence it is important to fully comprehend the world-views of its potential users to ensure that the ontology will be able to describe business models based on the business goals and purposes they perceive as valid.

Finally it is worth noting that in practice, given stakeholder, and particularly management, perceptions of current legal, social and financial constraints, there may be little observable difference between firms whose goal is based on an ecological modernist profit-first world-view and firms whose goals are based on the strongly sustainable world-view.

4.5.5.3 Business Design

The profit-first macro-social and economic purpose for human organizations introduced above (4.5.4) suggests that business design must be strongly related to the objective of achieving and growing monetary profitability.

Hence it is no surprise to find that the vast majority of business designs and the business models that describe those designs take this perspective.

The review of the profit first business design literature proceeds as follows. First the content of the literature will be presented using the structure provided in Figure 4-7 “maturity model for the evolution of the business model concept” (Definitions, Components, Models). While the literature is fairly self-consistent, there are, within the profit-first conception a number of notable criticisms and alternative perspectives. These are presented next. Extending the profit-first conception using ecological modernization, natural resource and environmental economic further increase the range of criticism and alternatives. These perspectives are presented last.

4.5.5.4 Definitions of Business Model

Writing in one of the early works related to business models, Fox, in defining his ontology engineering artefact, the Toronto Virtual Enterprise ontology (TOVE), states that it is " language in which enterprise knowledge can be expressed" (Fox, 1992).

Stähler, writing ten years later, in his PhD (Stähler, 2002b), summarizing the literature on business models to that point, states:

> *A business model is something very simple. It is a model of an existing business or a planned future business that answers the following questions:*
>
> – *What value the business creates for its stakeholders?*
>
> – *What does the firm sell?*
>
> – *How is the value in what configuration being created?*
>
> – *With what do we earn money?*
>
> (Stähler, 2002a, p.6)

Writing in a widely cited 2002 article in Harvard Business Review, a colleague of Porter, Magretta explains:

> *Business models are anything but arcane. They are, at heart, stories – stories that explain how enterprises work. A good business model answers Peter Drucker's age-old questions: who is the customer? And what does the customer value? It also answers the fundamental questions every manager must ask: How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?"* (Magretta, 2002, p.87).

She goes on, business models:

– *Describe, as a system, how the pieces of a business fit together* (p.91)

– *To be useful, must pass two critical tests: the narrative test (the story [must] make sense) and the numbers test (the P&L [must] add up)* (p.90)

– *[Are] not the same thing as a strategy, even though many people use the terms interchangeably* (p.91)

– *[Are required for] every viable organization […], whether or not its founders or its managers conceive of what they do in those terms* (p.91)

Writing at the same time, during the preparation of his PhD dissertation proposal Osterwalder states:

> *A business model is not a description of a complex social system itself with all its actors, relations and processes. Instead it describes the logic of a 'business system' for creating value that lies behind the business processes. A business model is the conceptual and architectural implementation of a business strategy and represents the foundation for the implementation of the business process.* (Osterwalder, 2002b, Slide 6)

> *A business model is nothing else than the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams.* (Osterwalder, 2002b, Slide 14)

Writing in another widely cited article on the role of business models in capturing the value from innovation Chesbrough lists the function of a business model is to articulate, in a design mode, an organization's:

– *Value proposition*

– *Market segment*

– *Revenue generating mechanism*

– *Value chain (i.e. its processes) which the firm operates (i.e. its suppliers, distributers, retailers, etc.)*

– *Cost structure and profit potential*

– *The value network (system) of which the firm is a part (suppliers, customers, complementors and competitors)*

(Chesbrough & Rosenbloom, 2002, pp.533-535)[55]

Summarizing Chesbrough's overall argument: a business model allows a competitive strategy to be determined to enable a firm to gain and maintain competitive advantage and justify the financial capital required.

By the time of completing his PhD Osterwalder had refined his definition of a business model:

> *An abstract conceptual model that represents the business and money earning logic of a firm* (Osterwalder, 2004a, p.15).

In his popular work derived from his PhD, on the advice of his practitioner community, he backed away from such an overtly monetary definition focused on purely profit maximization:

> *A business model describes the rationale of how an organization creates, delivers and captures value"* (Osterwalder & Pigneur, 2009, p.14).

However, implicitly, the measurement of "captured value" remains unchanged: only monetary units are considered valid.

Also writing in 2009, management information systems enterprise architect scholar Goethals offered the following pithy definition of a business model: "the what, how, where, who, when and why of doing business" (Goethals, 2009).

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[55] As of November 12, 2012 it has 1204 citations as per Google Scholar.

Summarizing all this in his 2010 PhD, Al Debei concludes that a business model is an abstract representation of an organization, be it conceptual, textual, and/or graphical, of all core interrelated architectural, co-operational, and financial arrangements designed and developed by an organization presently and in the future, as well as all core products and/or services the organization offers, or will offer, based on these arrangements that are needed to achieve its strategic goals and objectives (Al-debei, 2010, pp.93-97).

> *Put simply, the business model concept can be described as a 'logical story', or a 'blueprint' that explains the "way of doing business" so that strategic goals and objectives can be achieved* (Al-debei, 2010, p.13)

However, it appears what all these conceptions agree on is that a "business model is a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money" (Glissmann & Sanz, 2009, p.4) and that business models "seek to explain how value is created, not just how it is captured" (Zott, Amit, & Massa, 2011a, p.20).

4.5.5.5 Components of Business Models

A review of the components of business models proposed by scholars yields a significant 'long lists' of 40 or more component 'label's' (Goethals, 2009, Appendix 3; Osterwalder & Pigneur, 2005, Table 4 12-13; Shafer et al., 2005, Table 1 p.201; Zott, Amit, & Massa, 2011a, Table 2 pp.9-10). However, there is considerable conceptual overlap between these labels. This leads each scholar who proposes a list of concepts to be included in a business model to choose a list of 'labels' for the concepts they determine are required, each being able to cite multiple underlying studies to support the choices made.

While there is certainly not unanimity of the choices of the components required to model a complete business, there is a high degree of overlap. In late 2008, representing a synthesis of the choices, as a summary for executives, Johnson, Christensen and Kagermann provide Table 4-9.

Elements	Components
Customer Value Proposition	● Target customer (who) ● Job to be done (problem to be solved) ● Offering (what is sold and how it is sold)
Profit Formula	● Revenue model (volume x price) ● Cost structure ● Margin model ● Resource velocity
Key Processes	● End-to-end processes ● Rules and metrics ● Norms
Key resources	● Human ● Social ● Information ● Physical

Table 4-9: Elements of a Successful Business Model
(Summarized from Johnson, Christensen, & Kagermann, 2008, p.54)

Although there are a number of specific criticisms (discussed below), an overall analysis of the literature three years later, identified a large number of "first order and second order themes" across eight business model proposals, showing that all these themes align well to Johnson et. al.'s elements (Zott, Amit, & Massa, 2011a, Table 2 pp.9-10). Other scholars proposing lists of components for business models also align well to Johnson et. al.'s list of elements (Al-debei & Avison, 2010, Fig.2 p.368; Nenonen & Storbacka, 2010, Table II, p.50).

It is now over ten years since Osterwalder determined his original list of components for his Business Model Ontology, developed as part of his 2004 PhD. However, his work continues to distinguish itself because of the:

1. Thoroughness with which the choice and definition of each of the components is legitimated – both in terms of a logical explanation, academic theory and antecedents cited (Osterwalder, 2004a, pp.23-102).
2. Identification of levels of detail within components (i.e. attributes of components).

3. Use of and integration into a thoroughly and independently validated framework for structuring the components: the balanced scorecard (Kaplan, 1996; Kaplan & Norton, 2000).
4. Subsequent popular and academic validation of his list of components (see post 2004 works cited above).
5. Lack of equivalently thorough alternatives or derivatives found in the literature (it appears no one is standing on the shoulders of this giant).

Table 4-10 shows Osterwalder's complete list of 20 components (which he refers to as "elements". With two exceptions, he grouped these into related pairs of summary and detailed concepts, which he variously described as "pillars" or "building blocks". He then further gathered the components by the perspectives of the balanced scorecard[56] (with one exception).

Balanced Scorecard Perspective	**Summary Component[57]**	**Related Detailed Component (if any)**
Financial	Profit	
	Cost	Account
	Revenue	Pricing
Customer	Target Customer	Criterion
	Channel	Link
	Relationship	Mechanism
Internal Business Process	Value Configuration	Activity
	Partnership	Agreement
	Capability	Resource
Learning & Growth	Value Proposition	Offering
	Actor	

Table 4-10: Components of the Business Model Ontology
(Osterwalder, 2004a, p.44; Osterwalder, 2004b, Slide 7)

[56] Osterwalder, without explanation as to the reasons, did not use the original wording for the four perspectives, referring to them as "pillars". This is discussed in 7.2.15.
[57] Osterwalder refers to the pairs of summary components and related detailed components as building blocks. The nine building blocks form the basis for the simplified visual design tool that is powered by the BMO, the Business Model Canvas (Osterwalder, 2010, 2011). Sometimes he refers to components as "elements" of a business model.

4.5.5.6 Business Model Reference Models and Ontologies

Only a few of business models (i.e. the relationships between identified components) have been proposed at a detailed level. These have been built in two distinct ways: Those built

- From research about those relationships (Fox, 1992; Osterwalder, 2004a),
- By analyzing other business models (Andersson et al., 2006; Goethals, 2009).

Of these, Osterwalder's appears to remain the one with the most available detail for analysis, study, criticism and enhancement.

Further, Osterwalder's contribution, unlike some, is more formally (rigorously) described, using a variant of Entity Relationship Modelling (this is one of the reasons for the label 'ontology' being used rather than 'just' a model). Each component becomes an entity in an ERM, i.e. it is something that for a specific business has one or more instances. This means Osterwalder has been more specific than many about what is meant by each component and, for a specific business being described using the BMO, what constitutes an instance of an entity more likely to lead to a profitable business.

Finally, unlike TOVE (Fox, 1992) and the Reference Ontology for Business Models (Andersson et al., 2006) Osterwalder's Business Model Ontology is intended for direct use by business people to describe and design businesses.

Figure 4-11 shows the summary level of the Business Model Ontology expressed as a simplified Entity Relationship Model (ERM). Each of the components listed in Table 4-9 are shown as an entity (box), with lines representing the relationships between the components.

For convenience Osterwalder visually groups 19 of the 20 components into the four perspectives of the balanced scorecard; although for reasons not explained, he subtly re-label's each perspective (Financial becomes Financial Aspects, Customer becomes Customer Interface, Internal Business Process becomes Infrastructure Management, and Learning & Growth becomes Product). See 7.2.1.5 for a full discussion of these changes (Table 7-3).

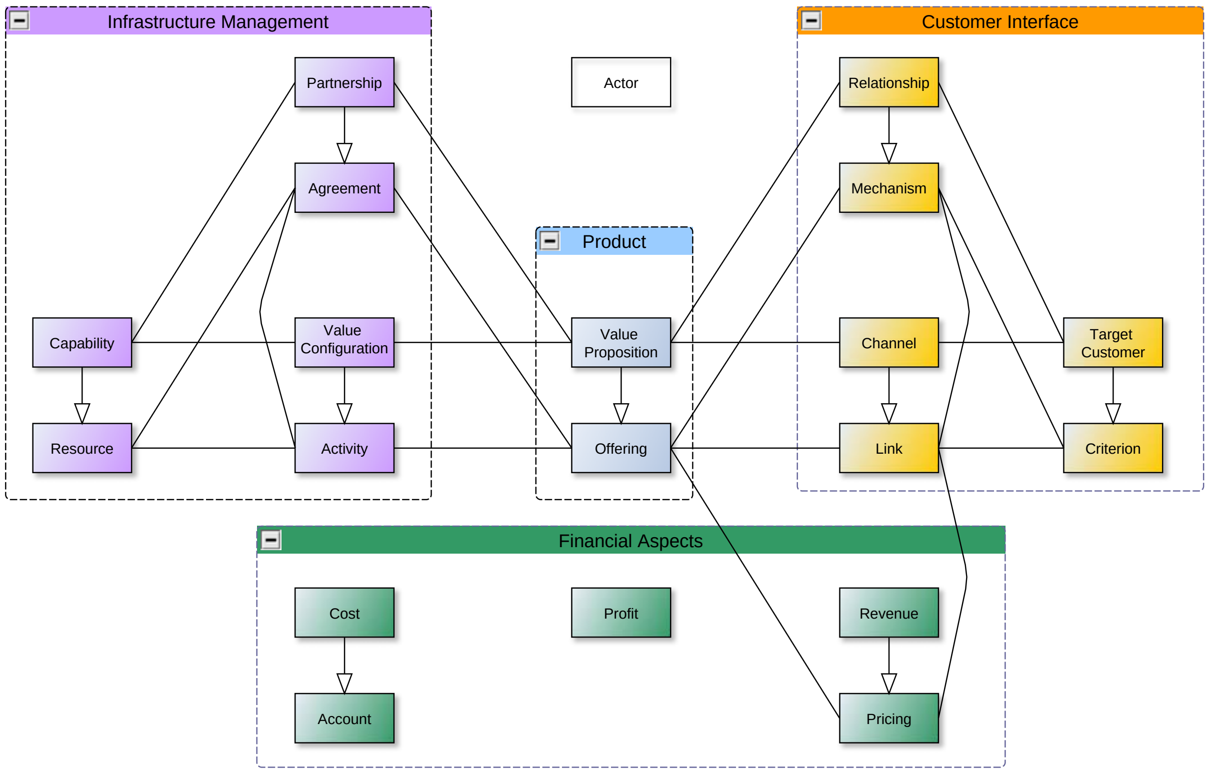

Figure 4-11: The Business Model Ontology – Summary
Larger version of this summary and the detailed representation of the BMO available in supplementary material (SM1 and SM2 respectively)
(Adapated from Osterwalder, 2004a, p.44; and from Osterwalder, 2004b, Slide 7)

The detailed view of the BMO, including labelled relationships with cardinalities and all the attributes of each of the elements, is provided electronically in as supplementary material accompanying this thesis (see SM2, described in Front Matter "Supplementary Materials"). This detailed ERM labels all the relationships, identifies relationship cardinalities and describes the attributes of each entity, assembled from the information provided in the PhD.

As an example of the close 'powered by' relationship between the BMO and the computerized version of the tool derived from the BMO, the Business Model Canvas: In the iPad and Web app BMC tools it is clear that the structure of the database which stores the business model designs uses many aspects of the detailed BMO ERM[58].

Finally, Osterwalder has made some of his earlier iterations of his ontology available, and these are instructive to help understand how his understanding both the components and their inter-relationships evolved (e.g. Osterwalder, 2002b, Slide 19-20).

4.5.5.7 Criticisms of Conceptions of Business Models

Within the (largely implicitly assumed) profit-first world only a small number of criticisms of the proposed components and relationships identified by Osterwalder have been made. In many cases the criticism has not been overt, rather it has taken the form of others identifying alternatives.

These criticisms are described in three groupings under the following three headings.

> *General, Goals, Governance and Measurement*
>
> The most coherent criticism comes from van Scheel, Rosenburg and von Rosing in the previously mentioned opening chapter "The Importance of a Business Model" (von Scheel et al., 2011) of "Applying Real-World Business Process Management in a SAP Environment" (Chase et al., 2011) .
>
> All these criticisms are identification of gaps in Osterwalder's work – i.e. his selection of components and their relationships is necessary but not sufficient to completely model a business. Table 4-11 presents the criticisms and the response (if any) from Osterwalder and / or others.

[58] Based on: correspondence of entity names, attributes on screen named identically to detailed BMO ERM, valid values of fields on screen the come directly from the detailed BMO ERM as well as valid combinations of instances of the entities (validated based on cardinality of relationships shown in the detailed BMO ERM) (Osterwalder & Smith, 2012; Smith, Osterwalder, Business Model Foundry GmbH, & Hortis - Le Studio, 2011).

Summarized Criticisms of BMO (von Scheel et al., 2011, pp.37-38)	**Response (if any)**
Does not include a representation of the main business goals, e.g. strategic business objectives, critical success factors and key performance indicators, which a holistic business model approach should include.	From analysis of other works (Goethals, 2009, Appendix 3; Shafer et al., 2005, Table 1 p.201; Zott, Amit, & Massa, 2011a, Table 2 pp.9-10) there appears to be general agreement that mission, vision and values are topics that inform and are informed by the business model and help to create the culture in the operating business: however, they remain outside of the business model.
Does not consider the important issue of goal setting, critical for developing the business model.	The process of goal setting, if it is understood to be related to creating value for customers, may be described using the BMO. This appears to be a misunderstanding by von Scheel et. al. The value of financial goals (costs, revenues, profit) may be captured in the respective entities although the modelling of these values over time is considered less relevant. Business modelling is not considered to be business planning, but a component of it or a replacement to it.
Does not include a representation of the main business issues/pain points and thereby corporate weakness, a holistic business model approach should include this for they represent the threat to the company's business model.	Osterwalder has made it clear that the evaluation of the strengths / weaknesses of a business model is best done, as is usual in other fields of design, by 1. Generating multiple (possibly) radically different business models that all meet the identified mission, vision and values. 2. Comparing the strengths and weaknesses between them and the business environment using SWOT and some variant of Porter's Five Forces model (Osterwalder & Pigneur, 2009, pp.200-225)
Does not include corporate structure and responsibility, which a business model should include.	Several authors concur that governance is lacking (i.e. decision making: how do the people who are allowed to decide on a specific topic make a decision) (Al-debei & Avison, 2010, Figure 2, p.368; Zott & Amit, 2010, Table 1 p.222)
Does not place enough emphasis on business model management and is thereby missing a continuous improvement and governance approach to the business model.	See above for governance. The process of continuous improvement, if it is understood to be related to creating value for customers, may be described. This appears to be a misunderstanding by von Scheel et. al.

Summarized Criticisms of BMO (von Scheel et al., 2011, pp.37-38)	Response (if any)
The linkages among competences, measurements and results is not explicit.	Identifying non-financial measures (both goals and actuals) appears to be a gap which is recognized in the analysis by a number of authors (Goethals, 2009, Appendix 3; Shafer et al., 2005, Table 1 p.201; Zott, Amit, & Massa, 2011a, Table 2 pp.9-10). The BMO does not conceptualize measures other than monetary costs, revenues and profit. Hence measures of quality, resource consumption, non-monetarily valued outputs (waste, pollution, etc.) are not easily included.
Does not consider the issue of performance measurements, which is vital for business modelling.	
Does not have a clear cause and effect linkage between the competencies, desired outcomes and measurements. Thereby the business model can help with possible strategic decisions.	

Table 4-11: Gaps in the Business Model Ontology from a Profit-First Perspective

Assets

The longitudinal studies of Malone et. al. introduced above (Lai et al., 2006; Malone et al., 2006) on the connection between business model performance and the nature of the assets being monetized raised another potential criticism of the BMO: its lack of a component that directly conceptualizes (financial) assets. Several other analyses of the literature on valid components of business models highlight that a sub-set of business model scholars also consider (financial)assets as an important component of business models (Goethals, 2009, Appendix 3; Shafer et al., 2005, Table 1 p.201; Zott, Amit, & Massa, 2011a, Table 2 pp.9-10).

Other than acknowledging this as a gap two other responses are possible:

1. The BMO is a "profit & loss" view of a firm – i.e. a snap shot at a point in time of revenue generating potential and likely matching costs. The balance sheet view, that would necessarily include assets (and liabilities) is 'out of scope'.
2. Financial resources required to launch and operate a business model (e.g. shareholder capital, bank loans, etc.) if considered significant to the success of the business model, may be captured using the capability and resources components.

Fixed assets may be represented in the same manner. If the relationships with the source of funding are considered important these may be captured using the partnership and agreement components.

Stakeholders

A final criticism of the BMO, ironically, comes simultaneously from Friedman's original purpose for a firm, generating as much profit as possible for owner stakeholders, and the more recent work on the competitive advantage of considering the needs of stakeholders in addition to customers.

That the BMO does not include owners (investors, shareholders, etc.) at first appears a major oversight until one returns to the impact of Drucker's observation of the importance of customers (Drucker, 1954) and Osterwalder's conception of a business model: it "describes the money *earning* logic of a firm" (Osterwalder, 2004a, p.15). Together this makes it clear that Osterwalder's whole business model is a description of the process of meeting Friedman's objective: creating monetary value for owner stakeholders.

Similarly, that the BMO does not include stakeholders other than customers at first appears a major oversight. Much recent research has focused on the importance to sustained competitive advantage of identifying and then developing value propositions[59] and hence relationships with a wide range of stakeholders (Donaldson & Preston, 1995; Freeman, 1984; A. L. Friedman, 2006, summarizes much recent research; J. A. Kay, 1997; Klassen & McLaughlin, 1996, pp.600-601; Rowley, 1997).

This criticism is both easier and harder to respond to. The actor, partnership / agreement, and to a lesser extent capability / resource components allow many non-customer stakeholders to be included. However, compared to the wide range of potentially valid stakeholders, and the fact that many stakeholders are simply roles of

[59] This is the work of Normann and Ramirez "A Theory of the Offering" (Normann & Ramirez, 1989). They have subsequently suggested that to address the multiple (over lapping) needs of multiple stakeholders (who may simply be roles of the same actors) the concept of "value constellations" need to replace simple "value propositions" (Normann, 2001; Ramirez & Ing, 2012).

the same actors[60], these structures do not appear to allow for a comprehensive description of many potential stakeholders, value propositions and relationships.

4.5.5.8 Criticisms and Extensions to Conceptions of Business Models

As shown above there is considerable activity in the conception of profit-first models – including the implicit and explicit criticism above.

Ecological modernization suggests that profits can be sustained and increased more reliably through business model innovation that proactively considers the biosphere and / or broader society.

As noted in 4.3.3 there is much less activity that explicitly considers sustainability and business models, criticising and extending the conception of business models described above. Hence in this section the search for criticism was broadened to consider the ecological modernist perspective of profit-first business models. The results of this search inform:

1. Potential detailed design principles related to additional components and their inter-relationships.
2. If components and relationships conceptualized in existing profit-first conceptions of business models should be revisited, revised or excluded.

Environmental Impacts

That financial profits can be increased and / or sustained by strategic (business model) innovations driven by reducing environmental impacts has been made repeatedly and with increasing force over the past 20 years (As some examples: Lanoie, Patry, & Lajeunesse, 2008; Porter, 1991; Porter, 2010).

An early article that takes a business model perspective is Griffiths & Petrick's 2001 publication in the International Journal of Operations & Production Management

[60] For example the same actor may have multiple roles: one individual may be an employee, a customer and an investor; many organizations may be suppliers and customers; many communities will be suppliers (of land, infrastructure, skilled labour) and recipients of employment and tax revenues.

"Corporate Architectures for Sustainability" [61] (Griffiths & Petrick, 2001). Griffiths & Petrick focus on two questions "what conditions characterize ecological and humanly sustainable corporations?" and "what alternative architectures can generate and institutionalize corporate sustainability?" After examining various aspects of ecological and human sustainability relevant to corporations they go on to consider three alternative architectures for sustainability (network, virtual, communities of practice). From this they develop propositions for further research which they suggest could lead to "specific architectures that link organizational design and corporate sustainability". The identified relevant propositions are as follows:

> *"Corporations that have specific architectural processes that capture and use ecological information that is integrated into strategic decision making will more likely demonstrate Corporate Sustainability performance than corporations without such architectures* (Griffiths & Petrick, 2001, p.1581).

This appears to reinforce the criticisms of the BMO that questions of governance and decision making are important to business models, and are perhaps particularly important to sustainability business models.

> *Corporations that have specific architectural processes that incorporate employee knowledge into strategic decision making will more likely demonstrate corporate sustainability performance than corporations without such architectures* (Griffiths & Petrick, 2001, p.1582).

This appears to reinforce the criticism of the BMO that stakeholders other than customers (in this case employees) are important to business models, and are perhaps particularly important to sustainability business models.

In their 2008 article in Organization & Environment "Conceptualizing a 'Sustainability Business Model' " Stubbs & Cocklin sought to develop a "sustainable business model" based on the premise that "organizations will only be

[61] The term corporate architecture is used such that its meaning is congruent with other articles general use of the term "business model".

sustainable if the dominant neo-classical model of the firm is transformed, rather than supplemented, by social and environmental priorities". Paradoxically, they then proceeded to do this based on "an ecological modernization perspective of sustainability". In this grounded theory research Stubbs & Cocklin conceived a table of characteristics of a sustainability business model. The columns of the table were characteristics related to each of the three dimensions of sustainability (economic, environmental, social), plus "multi-dimensional or holistic characteristics", the rows were grouped into either "structural attributes" or "cultural attributes". Stubbs & Cocklin went on to consider extensions to their ideas, which using a "stakeholder network approach" might enable a "systems-based sustainability business model". An illustration of such a model was developed, shown in Figure 4-12.

While their illustration clearly lacks any diagrammatic formalism, Subbs and Coklin's approach does appear to support:

- DDP3 – considering boundaries in sustainable business models is important (in this case natural environment, society, economy, stakeholder networks, industrial ecosystems, etc.)
- The earlier criticisms of the BMO that stakeholders other than customers (in this case the non-human, broader society in the form of government, communities, industry bodies and competitors) are important to business models, and are perhaps particularly important to sustainability business models.

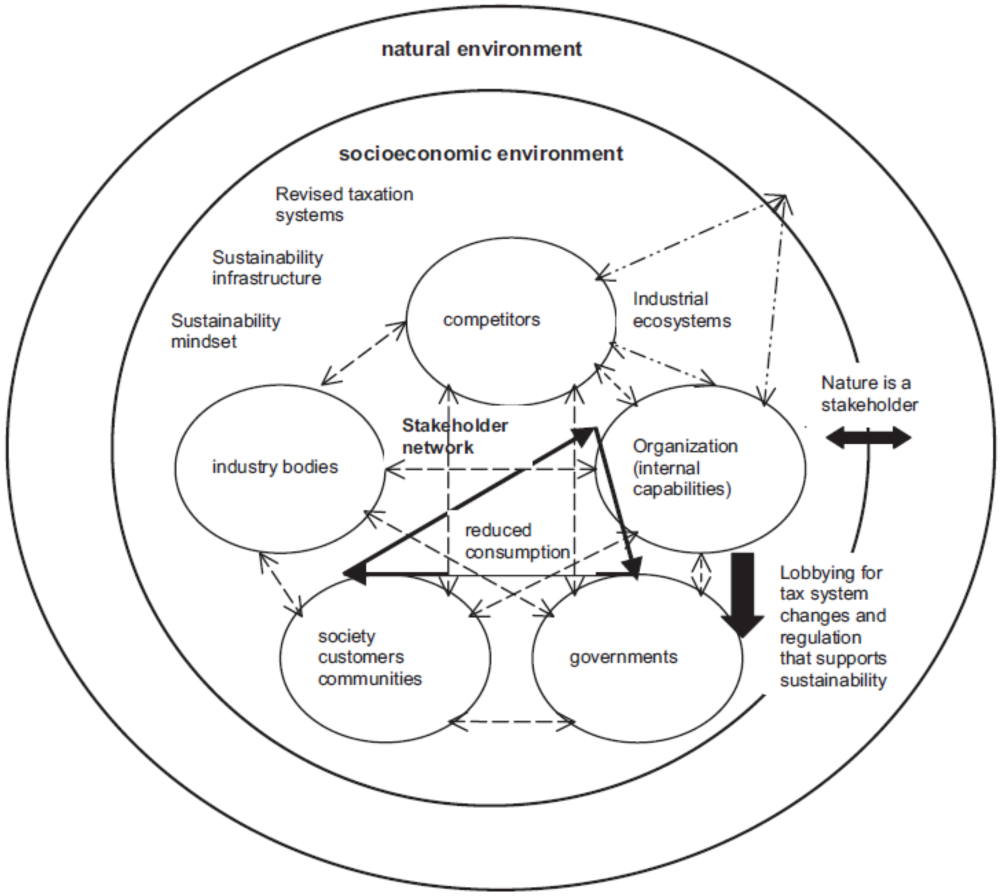

Figure 4-12: An Illustration of a Systems Based Sustainability Business Model
(Stubbs & Cocklin, 2008, Fig. 2 p.124)

Environmental Resources

The profit-first business models reviewed can be said to be aligned with the internal capabilities view of firm performance (i.e. the resource based view).

Some ecological modernist scholars have suggested extending the micro-economic resource based view to include natural resources; much as the macro-economic theories of natural resource and environmental economics have extended neo-classical macro-economic theory. An early example of this work is Hart's 1995 "A Natural Resource Based View of the Firm" (Hart, 1995).

The conception of a natural resource based view of the firm can be interpreted as criticising the lack of:

- A boundary between firms and the natural environment in for-profit business models.
- The conceptualization of stocks of resources (biophysical stocks) from which natural resources under the control of the firm are drawn and returned (unchanged or transformed).
- The conceptualization of flows of services (eco-system services) upon which activities of the firm are dependent (directly or over time).

Social Impact (Stakeholders)

Over the past eight years a number of scholars considered on the roles of stakeholders in growing and sustaining financial performance. These scholars asked whether additional (monetary) benefits could be obtained by a broader consideration of stakeholders, their needs, the context of the society in which they live and the collective needs of that society (J. A. Brown & Forster, 2012; Freeman, Rusconi, Signori, & Strudler, 2012; Gibson, 2012; Hart & Sharma, 2004; Heikkurinen & Ketola, 2012; Hillman & Keim, 2001; Pater & van Lierop, 2006; Reed et al., 2009; Yunus et al., 2010).

Of these Yunus et. al explicitly looked at social impact in the context of business models. In their work they attempt to identify components and their inter-relationships necessary to describe and design a 'social business model' which they defined define as "no-loss, no-dividend, [monetarily] self-sustaining that sells goods or services and repays investments to its owners, but whose primary purpose is to serve society and improve the lots of the poor". They suggest this contrasts with an NGO which is not designed to recover the majority of its costs from product and services revenues (Yunus et al., 2010, p.310-311).

Using a case study of a noted South Asian micro-finance organization at which the lead researcher holds a senior position, four components of a social business model are identified, as shown in Figure 4-13.

This can be interpreted as criticising the singularly monetary conception of profit in the for-profit business models. However, it is far from clear from this research how social profit is to be measured. For example "triple bottom line" accounting (based on neo-classical natural resource or environmental economic theory) quantifies social profit in monetary terms, even if this cannot be realized as a financial transaction (Norman & Maconald, 2004; Pojasek, 2009).

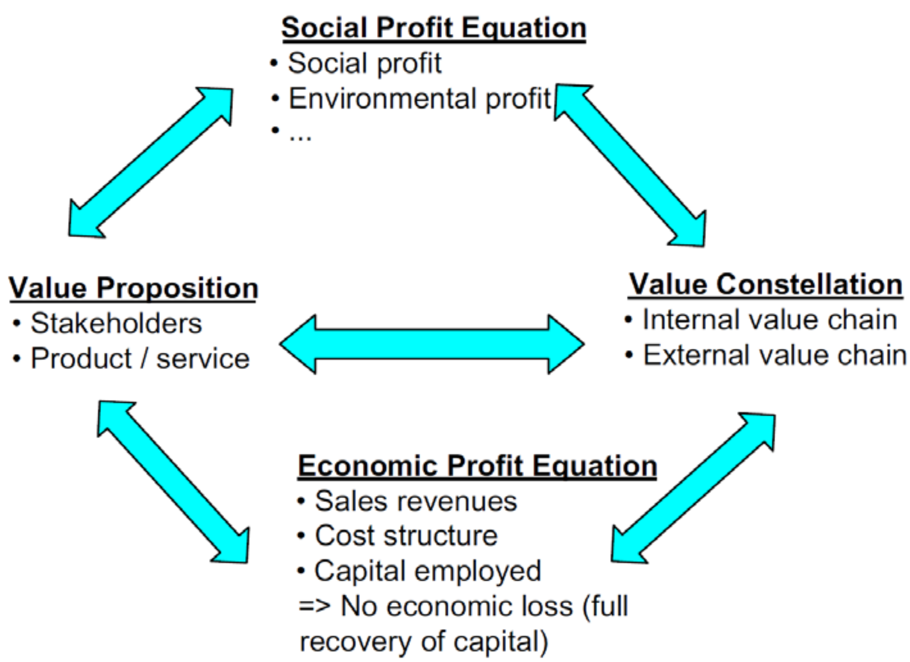

Figure 4-13: The Four Components of a Social Business Model
(Yunus et al., 2010, Fig.3 p.319)

These broader conceptions of stakeholders and the society in which they live can be interpreted as supporting:

– DDP3 – considering boundaries related to society and stakeholders in sustainable business models is important.

– The earlier criticisms of the BMO that stakeholders other than customers are important to business models, and are perhaps particularly important to sustainability business models.

– The idea that other types of value, in this case social value, may also need to be valued.

Interestingly Osterwalder & Pigneur (2011) and Darby & Jenkins (2006) also looked at the topic of society and stakeholders with an ecological modernization lens. However, neither appear to conclude that additional business model components or inter-relationships were required to be added to their existing models.

Changing Social Expectations

In addition to the potential general limitations of the ecological modernist position noted in 3.5.3.1 and 4.5.5.2 the other challenge with these criticisms is their fluid nature. As Eccles et. al. note: "changing social expectations" of what constitutes an acceptable externality is and will continue to change (Eccles, Ioanno, & Serafeim, 2012a; Eccles, Ioanno, & Serafeim, 2012b).

This means that over the past 15 years a constant stream of ecological modernist scholars have 're-evaluated' previous conceptualizations of the 'best practice' activities deemed sufficient to reduce the then 'acceptable externalities' (As examples: Hart, 1997; Hart & Milstein, 2003; Lubin & Esty, 2010; Nidumolu, Prahalad, & Rangaswami, 2009). Often these re-evaluations lead to new labels being generated for the new required 'best practices' that match the new social expectation. One recent example is Porter's attempts to suggest that activities of Corporate Social Responsibility (CSR) are no longer sufficient and that Creating Shared Value (CSV) is the new best practice (Porter & Kramer, 2011). However, upon examination, both are based on profit-first conceptions of the firm, albeit with (theoretically) reduced destruction of value related to biological and social needs due to the increasing social expectations of unacceptable externalities included in the recommended best practices.

This also means that a number of the science works found that did attempt theorization related to sustainability business models, or components of business models and their relationships, could ***only*** (as per 3.3.2) look at current ecological modernist 'best practices' (Birkin et al., 2009; Birkin, Polesie et al., 2009; Boons & Lüdeke-Freund, 2012; Darby & Jenkins, 2006; Hall & Wagner, 2012; Pagell & Wu, 2009; Seuring & Müller, 2008).

Looking back one can see that scholars (and practitioners) holding the profit-first world view have repeatedly re-evaluated their understanding of 'best practices' since the emergence of the modern environmental movement (Vaz, 2012 summarizes Walden, Leopold, Carson, Meadows, Schumacher, and Brundtland). Indeed using Holling's panarchy model (Figure 4-4) each of these works, at time of publication helped to provide a changed context of revised social expectations (from a larger scale) for subsequent organizational changes (at a smaller scale).

4.5.6 Profit-First Business Model Ontology Detailed Design Principles

The review of the profit first literature above appears to lend considerable support to DDP2 (conceptions of a business model) and DDP3 (boundaries of a business model). It also provides considerable additional detail to DDP2. These are captured in an additional detailed design principle.

4.5.6.1 Detailed Design Principles from Profit-First World-view

DDP5: Concepts within a Business Model (Profit First)

The SSBMO must be able to describe the concepts and their inter-relationships shown in Table 4-12.

Summary Component	Related Detailed Component (if any)
Actor	
Stakeholder	
Target Customer	Criterion
Channel	Link
Value Proposition	Offering
Decision (Governance)	
Relationship	Mechanism
Value Configuration	Activity
Partnership	Agreement
Capability	Resource
Process Measure (non-financial)	Activity
Profit	
Cost	Account
Revenue	Pricing
Asset	Account

For measures (financial and non-financial), attributes to capture both existing and desired values (goals) are required.

Table 4-12: Concepts within a Business Model (Profit-First)

4.5.6.2 Detailed Design Principles from Ecological Modernist Profit-First World-view

The review of the ecological modernist criticisms of profit-first business models and their components identifies a significant risk to the establishment of additional detailed design principles.

The ecologist modernist profit-first literature has recognized that its ability to define the components of such a model is limited by current conceptions of 'best practices' as expressed in extant phenomena. Further, these phenomena are known to be changing based on every changing social expectation. This means that any criticisms derived from these current ‘best practices’ and used to establish detailed design principles are quite likely to be superseded in a subsequent re-evaluation in light of further and expected changes in social expectations.

Thus any detailed design principles established directly from the ecological modernist profit-first literature risks breaking DDP4 (Timeframe for Validity).

In turn this suggests that a more principled basis for detailed design principles is advisable, such as those which might be derived from a broader and / or longer term perspective. This is the topic for the next and final part of this structured literature review.

4.6 The Strong Sustainability World-View (K0-SS)

4.6.1 Introduction

This section presents knowledge from the problem and solution domains that appears to be held as valid by scholars who take the ecological (systems) stance to business models (and relevant topics), but that would not be found valid by scholars who take the profit first stance.

The description of this world-view is provided at its most extreme point on the continuum of profit-first to strongly sustainable. This is not to indicate that in practice many people hold, let alone act upon, the position as stated. As illustration of this acknowledged reality one or two 'less extreme' examples are provided to aid interpretation and application.

By definition the sustainability world-view explicitly integrates ecological natural, social, economic, macro and micro perspectives used to structure this literature review (Table 4-3). Further the strongly sustainable world-view has a broad pre-hoc internal logic that connects these perspectives together. It is in a sense a designed world-view for a desired future, based on what is currently understood to be logical requirements for human and other life to flourish derived from a normative goal of achieving resilient strongly sustainable outcomes. In contrast, while the profit-first world-view also has an internal logic, this now has a post-hoc characteristic: this world-view now exists despite natural and social scientific knowledge that calls into question its fundamental tenants: that increasing GDP can, forever, lead to increasing flourishing.

The practical impact of this is that in this section, unlike in the description of the profit-first world view, from the literature, explicit:

- Commentary is provided on the pre-hoc connections, and
- Advice to managers is provided on how to operationalize the world-view.

4.6.2 Formal Sciences

The formal science knowledge relevant to this research is not changed by the strongly sustainable world-view. This knowledge was described in 4.4.2.

4.6.3 Natural Sciences

4.6.3.1 Introduction

As summarized in Table 4-3 there are three topics searched in the literature presented in this section: the perspectives on sustainability and flourishing, human world views, and human and non-human needs and satisfiers that are held to be true by questioner's who hold the strongly sustainable world-view.

4.6.3.2 Sustainability and Flourishing

As noted by its inclusion in the shared world-view (4.4.3), there is little of practical significance to business models in the natural science knowledge of sustainability and flourishing with which strongly sustainable scholars would disagree.

4.6.3.3 Human World-Views

The strongly sustainable world-view recognizes that simply being aware of and understanding the natural science knowledge of sustainability and flourishing, while necessary, is not sufficient to achieve strongly sustainable outcomes for humans and other existing life.

There are significant barriers to acting upon this understanding because of the world-view held by a majority of humans (at least in the Global North). Again, as one (perhaps extreme) example, using Ackoff's analysis of the broad context for these worldviews: the shift from the Machine Age to the Systems Age (Ackoff, 1974).

Ackoff suggests a world-view grounded in the "System Age" fully accepts non-determinism and expansionism (all objects and events, and all experiences of them, are parts of larger wholes). This is then a context for all goal seeking behaviours (teleology) that are necessarily co-productions (Ackoff calls this "producer-product" in contrast to the Machine Age "cause-effect", based on earlier work by Singer)[62].

[62] This is another example of the relevance hermeneutics (3.2.3.2 and 3.5.2.2)

From a theistic perspective, ironically, this can be seen as returning God to His position prior to Machine Age: God is everywhere, in everything, in every moment. The Machine Age God was required to become an ever more distant deterministic "first cause"' (as our reductionist understanding of proximal cause-effects improved, removing God from the details). It would appear such a systems age theistic conception of God is compatible with the common elements of Axial age religious teaching (i.e. pre-renaissance), rational humanist spirituality, and the latest neuro-physiological research (Goleman, 1997; Goleman, 2004; Haidt, 2006; Harris, 2004, pp.170-204).

Approaching this from the systems age perspective, as introduced in 3.4.6.1, Doppelt (2012), has proposed a set of aspirational personal commitments, which if undertaken, would enable individuals to act in alignment with the natural science of sustainability and flourishing. He describes this change in world-view as a shift from "me to we" thinking. This work appears to build on or be aligned with earlier work on such topics as quality and ethics (Ahmed & Machold, 2004) and environmental ethics (Benton, 2012).

Natural Law of Sustainability	**Commitment**
1. Law of Interdependence	See the ecological, social and economic system of which you are a part
2. Law of Cause and Effect	Be accountable for all of the consequences of your actions on those systems
3. Law of Moral Justice	When responding to those consequences abide by society's most deeply help universal principles of morality and justice
4. Law of Trusteeship	Respond to those consequences as well by acknowledging your trustee obligations and taking responsibility for the continuation of all life on the planet
5. Law of Free Will	Break free from the false beliefs that control your life and your organization and choose your own destiny

Table 4-13: The Five Commitments Required for the Shift from 'Me' to 'We'
(Doppelt, 2012, Box 1 p.147)

The world-view suggested in Table 4-13 enables the following beliefs:

- Humans are a species of animal (homo sapiens) with no privileged position with respect to other life in a single biosphere; as other life, humans are part of the abundant, generative, resilient biosphere and may die, survive, languish or flourish.
- Humans are believed to be the most intelligent species of animal within Earth's biosphere. As such, humans have fewer inalienable rights and significantly more responsibilities of stewardship for the well-being of each other, other life and our shared biosphere for current and future generations.
- Human society, along with all other life, is wholly dependent on, inter-dependent with, and contained within the biosphere (eco-system services and biophysical stocks).
- The human monetary economy is collectively constructed by, wholly dependent on and contained within human society.
- That human activity, necessarily within the biosphere, changes the biosphere.
- There are limits to the flourishing of all life, created by current biophysical states, processes and events and ultimately by available energy. When the limits are exceeded, conditions less compatible with the flourishing of all current life, including human, occur.

Just as world views unrelated to the nature and purpose of human organizations may cause some or all of the natural science knowledge of sustainability and flourishing to be considered irrelevant to business (4.5.3.3), a less than complete adoption of the above world-views and beliefs will prevent action on this same natural science knowledge.

If a business model designer's world-views aligns to Doppelt's Natural Laws of Sustainability, their definition of 'success' for a business would be bounded by them. This would then be a starting point to attempt to design a business model that has a goal of creating the conditions for strongly sustainable outcomes to emerge based on the natural science of sustainability and flourishing.

As two examples which reflect on attempts to adopt such a world-view and beliefs within a business context:

> ***First:*** *[Speaking to a audience of owners, financiers, managers and workers at a small mid-western U.S. manufacturer] What is sustainability? We have lots of definitions, but the one that works for me is embracing the three Rs: respect, relationship and responsibility. It is about respect for each other, respect for our earth, and respect for future generations. It is about relationships with one another, and relationships with future generations. And it is about responsibility – responsibility to do something. It is thinking ourselves as stewards, in a long line of stewards.* (Langenwalter, 2007, p.341)

> ***Second:*** *This time [referring to the Industrial Revolution as the last time], let us hope we can get it right, this business of creating wealth and sharing it with a growing human population, by asking our scientists to describe the benign rather than abusive, the renewable rather than extractive way forward. How do we increase the productivity of all resources and spare Earth from our abuse?* (Ray Anderson, CEO Interface Flor in the Forward to Robèrt, 2002)

Ehrenfeld analysed the reinforcing processes of making this shift in perspective and the balancing processes hindering it using Senge's Systems Archetypes (Senge, 1990, pp.378-390). Ehrenfeld observed just how challenging these balancing and reinforcing process make achieving the shift in world-view for individuals and collectively (Ehrenfeld, 2008, ch.2 "solving the Wrong Problem: How Good Habits Turn Bad" pp.10-21).

That adopting this world-view is (very) challenging, as discussed in 3.5.15 Achieving the Generic Benefits of Ontologies with the Sustainable Business Model Ontology, adds weight to the need to take an empathetic stance towards users of the SSBMO (ODP2).

4.6.3.4 Human and non-Human Needs and Satisfiers

While the human needs identified above (4.4.3.4) are thought to be universal, their satisfiers are known to be variable.

The same example presented in 4.5.3.4 also, perhaps, has some relevance to which satisfiers people holding the strongly sustainable world-view would consider more or less valuable.

The strongly sustainable literature is full of advice to managers on how to design satisfiers that, given an aligned world-view, would create value. Two examples:

First: Allen et.al. suggest that it is helpful in the context of strong sustainability to consider management as applied ecology (i.e. similar to the way engineering is seen as applied physics, chemistry or biology).

They provide managers just with three 'simple' avenues (and combinations) available for managers to create satisfiers that align with the fundamental limit of available high quality energy:

1. *Simplify to a level commensurate with the available energy.*
2. *Find more energy to subsidize increasing elaboration.*
3. *Use energy supplies as efficiently and effectively as possible.*

(Allen, 2003, p.391)

These authors then suggest that given the fundamental nature of the limit, if collectively managers choose create satisfiers which exceed the total available energy, the first path will (involuntarily) occur i.e. societal collapse (Tainter, 1988). Further, within these three avenues outcomes will be more effectively and efficiently created if managers:

- *Manage for productive systems rather than for their outputs*
- *Manage systems by managing their contexts*
- *Identify what dysfunctional systems lack and supply only that*

– *Deploy ecological processes to subsidize management efforts rather than conversely*

– *Problem solve with the knowledge that returns diminish over time as previous elaboration increases costs relative to benefits of future solutions at the same level of complicatedness.*

(Allen, 2003, p.14)

Second: Considering the challenge as one of design, McDonough and Braungart suggested managers consider the "design brief" for products, services and organizations that has (implicitly) been followed. They then compare this with a ecological modernist profit-first and strongly sustainable design briefs (McDonough & Braungart, 2002). This is shown in Table 4-14.

This returns us full circle to the strongly sustainable world view: the importance of acknowledging the connection between value and values. Ultimately, as encapsulated in the working definition of value, what we value depends on our values, values that arise from our world-view.

Current Profit-first[63]	Ecological Modernist Profit First[64,65]	Strongly Sustainable
Design a system of production that…		
…	…	… creates possibilities for:
Put's Billions of Kg of toxic materials into the air, water and soil every year	Releases less toxic materials while ignoring long term impacts	Abundance not limits
Produces materials so dangerous as to require constant vigilance by future generations	Produces less while living in fear	Everyone and everything forever not just me now
Places gigantic amounts of waste, irretrievably in holes all over the planet	Produces smaller amounts of useless / irretrievable waste	Flourishing by being not languishing by having
Slowly poisons people and ecosystems, limited only by thousands of complex regulations	Increases number, complexity and stringency of regulation	Positively contributing not doing less damage
Creates economic prosperity by reducing the number of people with valued work	Creates greater economic prosperity not human flourishing	Enduring not failing
Creates prosperity by digging up or cutting down natural resources then burying or burning them	Digs up and cut down less	Happiness not fear
Erodes the diversity of species and cultural practices with unknown consequences	Reduce speed of diversity loss	Confidence not uncertainty and distrust

Table 4-14: Comparing Design Brief's for Sustainability and Flourishing
(Summarized from Blend, 2007; Ehrenfeld, 2008; and McDonough & Braungart, 2002, p.18, ch.2 pp.45-67 & pp.89-91; Young & Tilley, 2006)

[63] McDonough and Braungart acknowledge that no one consciously adopted this design brief; however, they assert it is the design brief that we have unwittingly and largely unconsciously adopted as an unintended consequence of the Industrial Revolution.
[64] Ackoff, speaking well before Brundtland's eco-efficiency definition of "sustainable development", stated: becoming more efficient and effective at doing the wrong things, make the wrong outcomes emerge even faster. Attempting, even if failing, to achieve the right things will at worst slow down the wrong outcomes, and may actually help the right outcomes emerge. He notes however the significant issues of self-interest and risk, often created in organizations by measurement and reward systems need to be overcome for such attempts to be started. (Ackoff, 1974). Deming in his work on the context for producing quality makes similar observations (Aguayo, 1990; Deming, 1986).
[65] McDonough and Braungart refer to Ecological Modernist Profit First as "eco-efficiency" and Strongly Sustainable as "eco-effectiveness".

4.6.4 Ecological Macro- Sociology and Economics: Human Social Goals

As summarized in Table 4-3 there is one topic searched in the literature presented in this section: what, if any, goals for society exist if the questioner's world-view is strongly sustainable?

Being aware of and understanding the natural science knowledge of sustainability and flourishing within the strongly sustainable world-view, while necessary, is not sufficient to achieve strongly sustainable outcomes. To create the desired outcomes requires a new aligned macro-economic goal, or at least people willing to act to achieve the goal even if 'official' policy is not aligned.

Neo-classical economists (i.e. the current main stream majority), continue argue that maximizing GDP over-time, based on models of the economy consisting only of firms and households, remains both necessary **and** sufficient to human flourishing. However, even the originator of GDP understood that GDP was not a measure of human flourishing "...the welfare of a nation can […] scarcely be inferred from a measure of national income..." (Kuznets, 1934, p.7)

A large number of alternatives to GDP have been proposed as national or global indicators of flourishing, however, most look at only two of the three dimensions of sustainability (e.g. economic and social, social and environmental, or economic and social)[66]. Three apparently holistic indicators of macro-sociological, economic and environmental flourishing are:

- Sustainable Society Index (SSI) (Canadian Index of Wellbeing – CIW) [67]
- Happy Planet Index (HPI)[68]

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[66] Lawn provides an overview of Sustainable Development concepts and indicators (Lawn, 2006d). Examples of bi-dimensional indicators of national and / or global flourishing: Successful Societies Scale (SSS) (Paul, 2009), Gross National Happiness (GNH) (Tideman, 2011), Ecological Footprint (Kitzes & Wackernagel, 2009; van den Bergh & Verbruggen, 1999; Wackernagel et al., 1999). For a more complete list and analysis, including Index of Economic Well-Being , Genuine Savings Rate , Weighted Index of Social Progress (WSIP) , World Economic Forum's Environmental Performance Indicator (EPI) replaced Environmental Sustainability Index (ESI) , Canadian Environmental Sustainability Indicators (CESI) , Economic Well Being , Human Development Index (HDI) , and Quality of Life Indicators Project (QOLIP) see (Dimou & Upward, 2010)

[67] (Sustainable Society Foundation, 2011) and (Canadian Index of Wellbeing, 2011) [68](New Economics Foundation, 2011)

- Genuine Progress Indicator (GPI)[69]

Ecological economists have shown that to achieve sustained increases to any of these indicators requires an economy that is not growing relative to the fundamental limits identified by natural science (the so called steady state economy) (Daly, 1973; Georgescu-Roegen, 1975; Lawn, 2011; Schumacher, 1973). Since some natural science suggests we have already exceeded these limits this may require a reduction in some types of current economic activity (degrowth) (Kerschner, 2010; Latouche, 2010; Mario, 2009; F. Schneider, Kallis, & Martinez-Alier, 2010).

Ecological economists have also devised and simulated policies, broadly within the current socio-political system, designed to achieve flourishing within the fundamental limits (T. Jackson et al., 2011; Lawn, 2004; Lawn, 2010; Sorrell, 2010; Victor, 2008, ch.11 pp.191-224). Summarizing, the recommended policies are, implemented in priority order at a global level:

A. Limit physical flows of biophysical stocks in absolute terms (not relative to scale or in monetary terms) as per the natural science limits (Rockström, 2009)

B. Ensure distributional equity within these limits

C. Achieve allocative efficiency with the above resources using the market

Approaching the question of human social goals from the natural science perspective, the three natural science biospheric systems conditions (introduced in 4.4.3.2) are believed complemented by a fourth, socially oriented system condition:

4. In a society that is operating within the three biospheric systems conditions, people are not subject to conditions that systematically undermine their capacity to meet their needs (Robèrt, 2002; Robèrt et al., 2002; Tippett, 2001)

[69](Pembina Institute, 2011)

The four bio-social system conditions align well with the three summarized ecological economic global policy recommendations. The ecological economic policies also align with:

- Numerous other scholars seeking to understand and suggest inter-disciplinary (natural, social and economic science) frameworks for sustainability (Rueter, 2009; Sverdrup & Svenssson, 2004; Tainter, 2000; Tainter, 2003; Tainter, 2006; Voinov, 2008; Voinov & Smith, 2010).
- The overall definition of strong sustainability (3.5.3.1 Introducing Strong vs. Weak Sustainability) (Neumayer, 2010). Specifically, the ecological economic definition of strong sustainability removes possibility of ignoring the biospheric system conditions since some critical forms of natural capital cannot and will never be replaceable by other forms of capital. i.e. The ecological modernist / weak sustainability view is not possible: future technology will not always be available in time to counter the (unintended) results of breaches of the systems conditions.

To close this portion of the literature review, as an illustration of how this might be interpreted in an organizational context. In a recent book on sustainable strategic management, taking the strongly sustainable world-view, management scholars Stead and Stead state:

> *Sustainable strategic management's basic assumption is that the firm has a symbiotic, co-evolving relationship with the greater society and eco-system. This requires that strategic management analyze both competitive dynamics of communities of firms in which they participate and the other stakeholder networks and industrial eco-system networks in which the firm participates* (Stead et al., 2004, p.73).
>
> *We believe that assuming there are limits to growth, that there are no perfect substitutes for social and natural capital, and that humans live in communities and have values beyond the economic are important for sustainable strategic management. Further, we believe that these assumptions can be brought to life in business organizations if they are supported by the instrumental values [of strong sustainability].* (p.141).

4.6.5 Ecological Micro- Sociology and Economics

4.6.5.1 Introduction

As summarized in Table 4-3 there are two topics searched in the literature presented in this section: the purpose and goals of organizations and business designs that are held to be true by questioner's who hold the strongly sustainable world-view.

4.6.5.2 Organizations: Purpose & Goals

All four of the example ecological modernist studies that discussed current neo-classical conceptions of the purpose and goals of firms (4.5.5.2), to varying degrees, accept that the current levels of 'acceptable externalities' will only decrease over time. Ecological modernist conceptions of firm purpose and goals limit the attempt that can be made to create conditions from which sustainable outcomes can reliably emerge: such conceptions assume that there will be 'externalities' that may be reduced to acceptable levels, so as to 'do less harm', rather than conceptualizing a need to proactively attempt to 'do good'. The result: the ecological modernist position is not able to anticipate the purpose and goals of strongly sustainable organizations (4.5.6.2).

This prompts two questions, within the overall macro-social and economic goal and policies required to directly attempt to achieve flourishing (4.6.4):

> What is the purpose and goals of a strongly sustainable organization?
>
> How would such an organization define success?

Blattberg, introduced earlier, articulates the challenge well:

> *Say [CEOs and shareowners] forgo talk about long-term profit maximization through enlightened interest and turn instead to an appreciation of the genuine conflicts that can take place between sometimes incommensurable values, that they purport to be so sensitive to. It is such conflicts which lead, at times, to the inescapable need to compromise some or all of the conflicting values. If pluralists truly appreciate this,*

> *as we might expect they would, then we could indeed say that for them the corporation should be, to some extent, really accountable to all of its stakeholders and so that it should try to meet their needs even though this will often mean forgoing real profit, in both the short and long term. But there is a problem with taking this route. For what, we might ask, of the competitive realities of the market? […] There are, at least in the United States, numerous forces at play which encourage managers to maximize profit by allocating resources efficiently, not to mention disciplines against inefficient behaviour. Indeed, as many have argued, managers in that country are so directed toward short-term profits as a way of maintaining the value of a company's stocks that important long-term considerations are often neglected by necessity. Managers may wish to recognize the requirements of values other than profit, but often this has to remain but a wish. After all, if the business environment is so competitive that attending to stakeholders other than shareholders threatens the very survival of the firm, then surely the manager will have to act accordingly. Indeed, with the increasing globalization of the market economy accompanying the expansion of free trade, we might expect this to apply to all corporations, not just those in the United States. It seems, then, that the pluralist who would take this route comes up against the bars of what [Max] Weber famously referred to as the 'iron cage' of modern capitalism.* (Blattberg, 2000, p.177)

What the earlier ecological modernist examples show are examples of what Blattberg refers to as the "pluralist profit-seeking paradox": by not directly pursuing their self interested goal of profit maximizing in the short and long term (i.e. taking an inclusive or pluralist approach to understanding a diversity of stakeholder needs and creating high value satisfiers) they are in fact maximizing their self-interest!

To resolve this paradox Blattberg suggests taking a leaf from Ackoff's systems problem solving toolbox: step back to look at the context of the paradox (in this case monetary profit) and ask if there is not a way of reconceptualising the problem so as to dissolve the paradox (Gharajedaghi, 2011, pp.104-108).

Blattberg observes that problem with the profit-first and ecological modernist conceptualization of profit is that it is "a thin, highly precise, independently distinct value" (Blattberg, 2000, p.178) "with the result that maximizing it through instrumentally efficient behaviour is considered an activity which is itself independently distinct from those aimed at meeting the requirements of non-shareholding stakeholders" (Blattberg, 2000, p.179).

Reconceptualising to arrive at a strongly sustainable conception of profit[70], what herein will be referred to as "tri-profit" to distinguish it from other monetary and non-monetary conceptions of profit:

> *Corporations that ultimately attain the largest [monetary] bottom-line earnings tend to do so because they consider the requirements of stakeholders other than their shareholders as expressing, not concerns other than, or beyond [monetary] profit, but nothing but [tri-]profit itself, it being understand as including much more than simply the [monetary] bottom line.* (Blattberg, 2000, p.180)

A synthesis of the literature reviewed suggests a working definition of tri-profit in the context of business models:

> Tri-Profit is a metric calculated as the conceptual 'sum' of the net harm or benefit arising as a result of firm's activities in each of the environmental, social and economic contexts in a given time period.

As far as is known tri-profit is a neologism, and is a conceptual contribution of this research.

In practical terms Blattberg suggests that firms are able to generate this tri-profit because the various stakeholder needs and their diverse satisfiers, including shareholders desire for monetary profit, are "to some extent integrated with each other, and so in the best case, open to a non-compromising reconciliation [via conversation] as a means for overcoming conflicts between them." (Blattberg, 2000, p.180)

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[70] Blattberg refers to such conceptualizations as patriotic in comparison to pluralist (i.e. profit-first ecological modernist) or a unitary view (i.e. Friedmanian profit-first).

Conversation, then, is what good corporate business is all about. That is why corporations should aim to compete not, with the neo-classicist, strictly to make money, nor, with the pluralist, to make money as well as to contribute to a number of other independently conceived social needs, but rather to be 'successful' which, in this reading, consists of contributing profitably to a whole constituted by the integration of all of these aims. And that whole, moreover, is but the [needs and satisfiers] shared in common by all of the corporation's stakeholders, including its share-holders. The corporation should thus be understood as a kind of community, one embedded within the larger community that is the political society. When this happens, we get a very different conception of business practice than that advanced by the [unitarist or] pluralist. (Blattberg, 2000, p.180)[71]

Blattberg's analysis is merely one of a range of practitioner and scholarly re-examination of the purpose of business within a society whose macro goal is direct maximization of flourishing, rather than the generation of flourishing via maximization of GDP per capita. These other works include:

- Scholars engaging in dialog directly with senior management and capitalists on the question "what's a business for?" (Handy, 1991; Handy, 2002; Handy, 2008)
- Scholarly practitioners in dialog directly with senior management and capitalists proposing maturity models of sustainable business that indicate a discontinuity between the lower levels (achievable through profit first ecological modernization) and the highest level (only achievable through a reconceptualization of firm purpose and goals) (Willard, 2002; Willard, 2012, Fig 1.15 pp.20-21).
- Scholarly work connecting macro-ecological economics concepts of strong sustainability to micro-economic firm purpose and goals (see 3.5.3.4 A Definition of Organizational Strong Sustainability & Doig, 2003; Doig, 2009)

[71] Blattberg cites a work of Dreyfus, Flores and Spinosa as a "well articulated" "different conception of business practices" aligned with his patriotic view (Spinosa, Flores, & Dreyfus, 1997).

- Practitioners engaging in dialog directly with senior management and capitalists on: an ecological foundation to business design, management and leadership (Hurst, 2012; Hutchins, 2012a; Hutchins, 2012b; Hutchins, 2012c; Upward, McDougall, & Hoeller, 2012), manifestos (Friend, 2005) and action plans to implement these ideas (Beloe, Elkington, Kavita, Thrope, & Zollinger, 2004; Sipkens & Thrum, 2012).
- Scholars considering the relationship of broader society and its collective goals to groups of stakeholders' of individual organizations and their individual and collective needs (Bonnafous-Boucher & Porcher, 2010).
- Scholars looking at how shifts in the Global Problématique provide opportunities for senior management to strategically adopt reconceptualizations of firm purpose and goals (Abraham B. (Rami) Shani & Mohrman, 2011; Aras, 2009; Karns, 2011; Stead et al., 2004).
- Scholars looking at how to adjust accounting concepts and processes that accommodate pluralist conceptions of profit consider the ontology of accounting (i.e. positivist discrete objective) by proposing a change in that ontology (to a more subjective interconnected set of events) to accommodate sustainable development (Birkin, 2000).
- Students examining what value is seen as socially desirable by stakeholders and the barriers to its achievement within the profit-first world-view (Sawhney, 2011).
- Scholars critiquing ecological modernist conceptions of valuation, in monetary terms, of social and environmental profit (Pojasek, 2009).
- Scholars critiquing ecological modernist conceptions of the firm (and the economy) as being independent from rather than inter-dependent with society and the environment (Marcus et al., 2010).

Table 4-15 summarizes the literature and provides a comparison of various aspects of the definition of monetary profit and tri-profit.

	Monetary Profit	Tri-Profit
Measurement System	Single, numeric: Monetary	Multiple, numeric and non-numeric: scientific units, social "units", monetary units
Comprehension Rules	Simple: +ve numbers good, -ve numbers bad	Complex and under-developed
Decision Rules	Increase monetary revenue faster then increasing monetary costs (profit can be maximizing by any means within the law that minimizes costs and maximizes revenue)	Complex and under-developed (tri-profit maximization is dependent on interaction of its component 'cost' and 'revenue' variables)
Discipline	Single sub-discipline of micro-economics: finance and accounting	Fundamentally inter-disciplinary

Table 4-15: Comparison of Monetary Profit and Tri-Profit

As the final, and perhaps most practical evidence of the reality and acceptances of the strongly sustainable world-view reconceptualization of firm purpose and goals, is the work of B Lab (B for Benefit). This NGO has now successfully had legislation passed in 11 U.S. States (with 16 more working underway, along with one Canadian province) that creates a new class of incorporated legal entity (B Lab, 2012). A "B Corp" is one which is mandated to integrate the achievement of monetary, social and environmental profits. This contrasts strongly with other classes of incorporated legal entity that embody the unitary profit-first world view. Depending on jurisdiction, existing classes of corporation may enable owners to personally sue officers and members of boards of directors if owners believe decisions have been taken which do not maximize (their) short term profits. Currently there are 103 firms that are incorporated under this legislation, the largest of which is Pategonia.

Further, B Lab has created the Benefit Impact Assessment Survey. This can be thought of as the first attempt at GAAP (or IFRS)[72] for the social and environmental dimensions of tri-profit. This transparent tool, whose results are audited, can be used by stakeholders to rate and rank performance on the social and environmental dimensions, just as audited financial

[72] Generally Accepted Accounting Principles; International Financial Reporting Standards

statements allow the same rating and ranking on monetary performance. Currently, another 547 firms have chosen to have their environmental and social performance assessed and audited using this standard; this allows them to claim to be a "certified B Corp" (Upward, 2010d, Appendix A).

While not currently part of the current B Corp legislation, perhaps we can judge progress towards this world-view by the subsequent emergence of legislation allowing firms to declare environmental, social and / or monetary bankruptcy.

Earlier it was observed that in practice, given stakeholder perceptions of current legal, social and financial constraints, there may be little observable difference between firms whose goal is based on a 'strongly' ecological modernist profit first world-view and firms whose goals are based on a strongly sustainable one, but where strongly sustainable best practices are not being implemented consistently.

However, this is not of practical importance. The natural science paints an increasingly clear picture of how anthropomorphic change in the biosphere will (dramatically) impact humanity and other life[73] and guidelines for achieving flourishing of human and other life despite these changes. Firms and stakeholders that take (any) proactive steps to adopt strongly sustainable world-views and hence increase their resilience to the triggered panarchic phase changes will be more likely to flourish. Firms that tend to take the slower evolutionary ecological modernist approach are more likely to languish, merely survive or die.

That the exact time frames for such phase changes at the macro, meso or micro scales of the environment, society and the economy are unknown does nothing to lessen the respective risks of each choice.

Returning to the question introduced under this heading: What is the purpose and goals of a strongly sustainable organization given the broader macro-social goal of attempting to achieve flourishing? For an organization to help achieve the macro-social goals of strong sustainability requires a reconceptualization of organizational success and its measurement:

[73] At some level ecological modernists appreciate this; why else would they expect social norms of 'acceptable externalities' to continue to change in the direction of society accepting fewer externalities?

from a unitary focus on the maximization of monetary profit to the integrated achievement of 'tri-profit'.

4.6.5.3 Business Design

As first observed in 2.1 there is an overriding but implicit normative assumption in all of the business design literature reviewed in 4.5.5.3-4.5.5.8: the profit-first world-view the authors' assumed they shared with all users of this knowledge. This represents the vast majority of the literature of business design found (4.3.3).

As a result of this assumption, this literature and practitioner tools derived from it do not include the natural science knowledge of sustainability and flourishing. This makes this literature and related tools hard to apply and / or irrelevant for those business model designers who wish to design a business model based on a strongly sustainable world-view.

Under the following headings a review of the literature is presented that explicitly takes a strongly sustainable world-view of the purpose and goals of how organizations can be designed so they reliably achieve tri-profitability.

- 4.6.5.4-4.6.5.8 reviews literature that is suggestive of concepts that might be considered as candidate components for strongly sustainable business models.
- 4.6.5.9 reviews the few strongly sustainable business model reference models found.
- 4.6.5.10 closes with some observations on the strongly sustainable business model literature.

4.6.5.4 Stakeholders

The idea that businesses can gain competitive advantage by considering the needs of stakeholders other than owners and customers has been prevalent for some time. Further, based on universal human needs and satisfiers (Table 4-8), some literature was reviewed suggesting that these needs are applicable to all life: human and non-human.

However, the consideration of "moral justice" in regards to strong sustainability (#3 Table 4-13) gives an extra dimension to the consideration of stakeholders. For example:

- Heikkurinen and Ketola suggest that typical profit-first stakeholder approaches "outsource ethics" and suggest that a stakeholder awareness approach which in-sources ethics is more aligned with conception of tri-profit (Heikkurinen & Ketola, 2012).
- Starik suggests that non-human nature is a legal-political-economic entity that businesses should also be considering as a direct stakeholder (without human intermediaries, such as an NGO) (Starik, 1995).
- Holifield suggests that Actor Network Theories inclusion of the non-human can be used as an approach for stakeholders to gain a critical understanding of and subsequently achieve environmental justice (Holifield, 2009).

4.6.5.5 Leadership and Governance

Some of the strong sustainability business design literature concerns leadership and organization design related to governance.

Cavagnaro & Curiel, focus specifically on a "framework to introduce leadership for sustainability in higher education" (Cavagnaro & Curiel, 2006a)[74].

The title of this article belies the potentially generalizability of the model developed. The broader context for this model is a range of organizations in the services industries (Cavagnaro, 2007; Cavagnaro & Raghoebarsing, 2008). Subsequent to its original development the model for higher education has started to be applied in active research programs related to tourist/travel service organizations in the Netherlands and one of its dependents (Curaçao). It is also being actively developed[75].

Cavagnaro & Curiel's model for conceptualizing the elements of leadership for sustainability is shown in Figure 4-14.

[74] Originally presented at the 2006 conference of the International Association for Business in Society. This conference partly organized by Prof. Husted from the Schulich School of Business
[75] Personal communication with Prof. Cavaganaro May 16, 2011

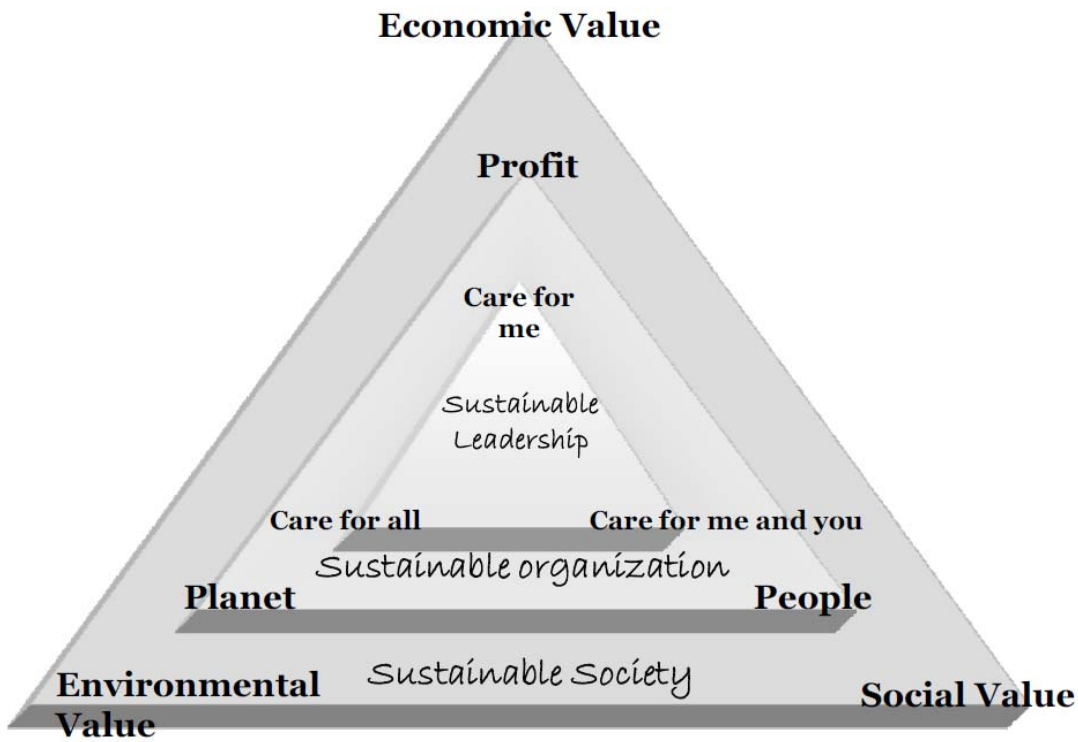


Figure 4-14: The Three Levels of Sustainability (TLS) Framework
(Cavagnaro & Curiel, 2012, Fig.1 p.2)

This approach to leadership is complemented by the "declaration of sustainable business" that envisages specific commitments leaders can make on each of the dimensions shown in Figure 4-14 (Friend, 2005).

Nobel prize winner for Economics Elinor Ostrom has identified a number of inter-organizational design principles to enable successful long term management (and productivity) of common pool resources (Ostrom, 2008). These are summarized in Table 4-17.

Finally, Schwanigner suggests that Beer's Viable Systems Model (VSM) of organizational design can be applied to help managers identify the many governance relationships between levels within the context for their organization (municipality, region, country, continent, world) and between that context and the organization (Schwaninger, 2008, p.44 & Fig. 3 p.44).

1A. User Boundaries: Clear and locally understood boundaries between legitimate users and nonusers are present.
1B. Resource Boundaries: Clear boundaries that separate a specific common-pool resource from a larger social-ecological system are present.
2A. Congruence with Local Conditions: Appropriation and provision rules are congruent with local social and environmental conditions.
2B. Appropriation and Provision: Appropriation rules are congruent with provision rules; the distribution of costs is proportional to the distribution of benefits.
3. Collective Choice Arrangements: Most individuals affected by a resource regime are authorized to participate in making and modifying its rules.
4A. Monitoring Users: Individuals who are accountable to or are the users monitor the appropriation and provision levels of the users.
4B. Monitoring the Resource: Individuals who are accountable to or are the users monitor the condition of the resource.
5. Graduated Sanctions: Sanctions for rule violations start very low but become stronger if a user repeatedly violates a rule.
6. Conflict Resolution Mechanisms: Rapid, low cost, local arenas exist for resolving conflicts among users or with officials.
7. Minimal Recognition of Rights: The rights of local users to make their own rules are recognized by the government.
8. Nested Enterprises: When a common-pool resource is closely connected to a larger social-ecological system, governance activities are organized in multiple nested layers.

Table 4-16: Design Principles for Governing Sustainable Resources
(Ostrom, 2010, p.653)

4.6.5.6 Design Tools, Frameworks and Principles

Robèrt et. al. propose a 5 level meta-framework for planning in complex systems to structure and relate knowledge, goals, strategies, actions, tools and metrics focused on achieving strategic sustainable development. They use the framework to show how a number of common works in each of the categories are complementary and not contradictory, e.g. Framework for Strategic Sustainable Development (that includes the four biospheric systems conditions introduced earlier), Life Cycle Assessment (LCA), Factor X, Total Material Flow, Environmental Management Systems (ISOI40001), etc. The meta-framework is shown in Figure 4-15.

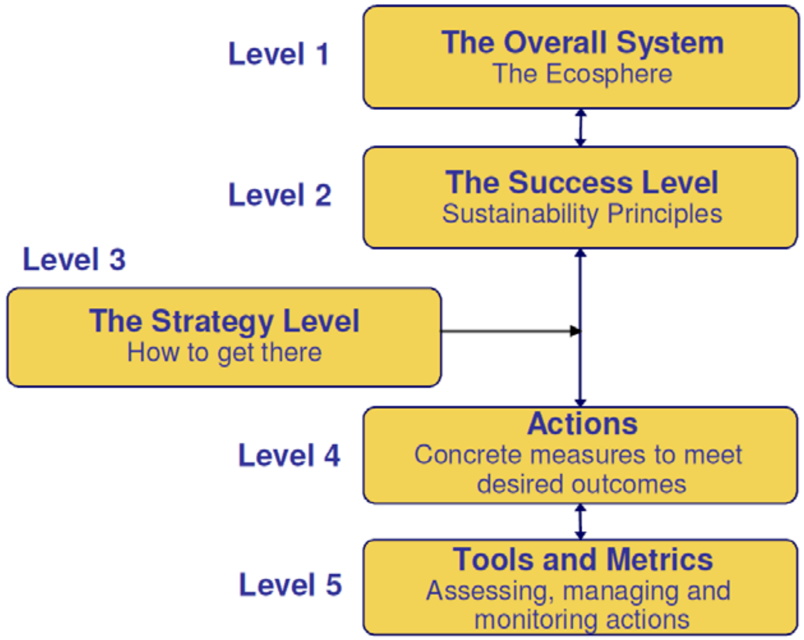


Figure 4-15: Five Level Meta-Framework for Planning in Complex Systems
(Simplified from Robèrt et al., 2002, Fig.1 p.199)

A number of authors have suggests principles for sustainable business model design. Willard and Bansal's proposals are summarized in Table 4-17

Willard's Five Principles for Sustainable Business Model Design (Willard, 2010a)	**Bansal's Five Principles for Sustainable Business Model Design** (Bansal, 2011)
Radical resource productivity	Diversity
Investment in natural capital	Modularity
Ecological redesign	Openness
Service and flow economy	Slack Resources
Responsible consumption	Matching Cycles

Table 4-17: Suggested Principles for Sustainable Business Model Design
(Summarized from Bansal, 2011; Willard, 2010a)

Based on empirical study Parrish identifies a number of "perpetual" business design principles along a number of dimensions of business design that can inform strongly sustainable business model designs, as shown in Table 4-18.

Design Requirement	**Principle of 'Perpetual Reasoning'**
Purpose – justifying existence	Resource perpetuation (Produce benefit stream by enhancing and maintaining quality of human and natural resources for the longest time possible).
Efficiency – achieving synergies	Benefit Stacking (Stake as many benefits as possible onto each operational activity)
Tradeoffs – balancing competing objectives	Strategic satisficing (Strategically identify satisfactory outcomes of multiple objectives)
Criteria – prioritizing decision choices	Qualitative management (Use expected quality of outcomes and processes as decision criteria)
Inducements – allocating benefits	Worthy contribution (Structure benefit streams to privilege worthy recipients by providing opportunities for contributing to the enterprise)

Table 4-18: Perpetual Reasoning Organizational Design Principles
(Summarized from Parrish, 2010, Table 3 p.517)

Based on 30 years of empirical research on the design of socio-technical systems, Trist and Emery identified principles of job design that yield high quality productivity for organizations while simultaneously providing employees with satisfying jobs: ones in which individuals could flourish. These principles, split between extrinsic and intrinsic aspects of the job and work are summarized in Table 4-19.

Extrinsic	Intrinsic
Fair and adequate pay	Variety and challenge
Job security	Continuous learning
Benefits	Discretion, autonomy
Safety	Recognition and support
Health	Meaningful social contribution
Due process	Desirable future
Conditions of employment: Socio-economic	The job itself: Psycho-social

Table 4-19: Properties of Highly Productive and Satisfying Jobs
(Trist, 1981a, Table 2-1 p.30)

4.6.5.7 Biomimicry Frameworks and Principles

Biomimicry is the idea that the natural world can act as a source of strongly sustainable design principles in a variety of fields (Benyus, 2002), since life:

- Runs on sunlight
- Uses only the energy it needs
- Fits form to function
- Recycles everything
- Rewards co-operation
- Banks on diversity
- Demands local expertise
- Curbs excesses from within
- Taps the power of limits

A number of authors have attempted to identify biological principles for organizational design. In his 2012 book "The Nature of Business: Redesigning for Resilience" Hutchins suggests six overall bio-inspired business model design principles: resilience, optimizing, adaptive, systems based, values-based and life-supporting. These are summarized in (Hutchins, 2012a), expanded in (Hutchins, 2012b) and reviewed in depth in (Upward et al., 2012).

Dargent, an MBA student, working with Hutchins, recently completed a critical literature review of works seeking to apply biological principles to business practices concluding that "natures principles appear to provide a holistic framework that is highly relevant to current business issues and trends" (Dargent, 2011, p.46).

Finally Jensen-Waud used the biological rhizome (the connection between roots and stem) as model to help reason with and think about wicked problems such as enterprise architectures (Jensen-Waud, 2011).

The single biggest criticism of the application of biomimicry to organizational design to date is the apparently post-hoc and analogous nature of all the provided examples. i.e. it appears an organization was designed and then a pattern in nature was noticed to have similar characteristics (Upward et al., 2012).

4.6.5.8 Industrial Ecology Frameworks and Principles

A specific form of biomimicry, one that predates Benyus work, is industrial ecology, sometimes know as industrial symbiosis. This is the idea that industry should have no net waste, just as nature has no net waste: the waste of each business being used as valuable input to another (Cohen-Rosenthal, 2003).

Despite the obvious attractiveness of such a design principle, and although there is considerable academic work (Côté, Grant, Weller, Zhu, & Towes, 2006; Hollander, 2000), including the Journal of Indistrial Ecology, as well as successful practitioner work (Eco-Industrial Solutions Ltd., 2008), more detailed business model design principles based on industrial ecology were not located.

4.6.5.9 Business Model Reference Models

After a considerable search, a number of business models that explicitly considered elements of strong sustainability were identified, although with one exception, all are published outside the peer review process, and a majority are self-published. A number of the models found were extensions of Osterwalder's Business Model Ontology, indicating other practitioners identified the same gap that this research identified (2.1).

Cloverleaf Model

Jorgensen's 1993 "clover leaf" model of organizational sustainability (Jorgensen, 1993) (Figure 4-16), along with a tool for assessing the sustainable development maturity of an organization (Table 4-20), was the only model found published in a peer reviewed journal. This model was subsequently used by at least one other scholar in published work (Birkin, 2000).

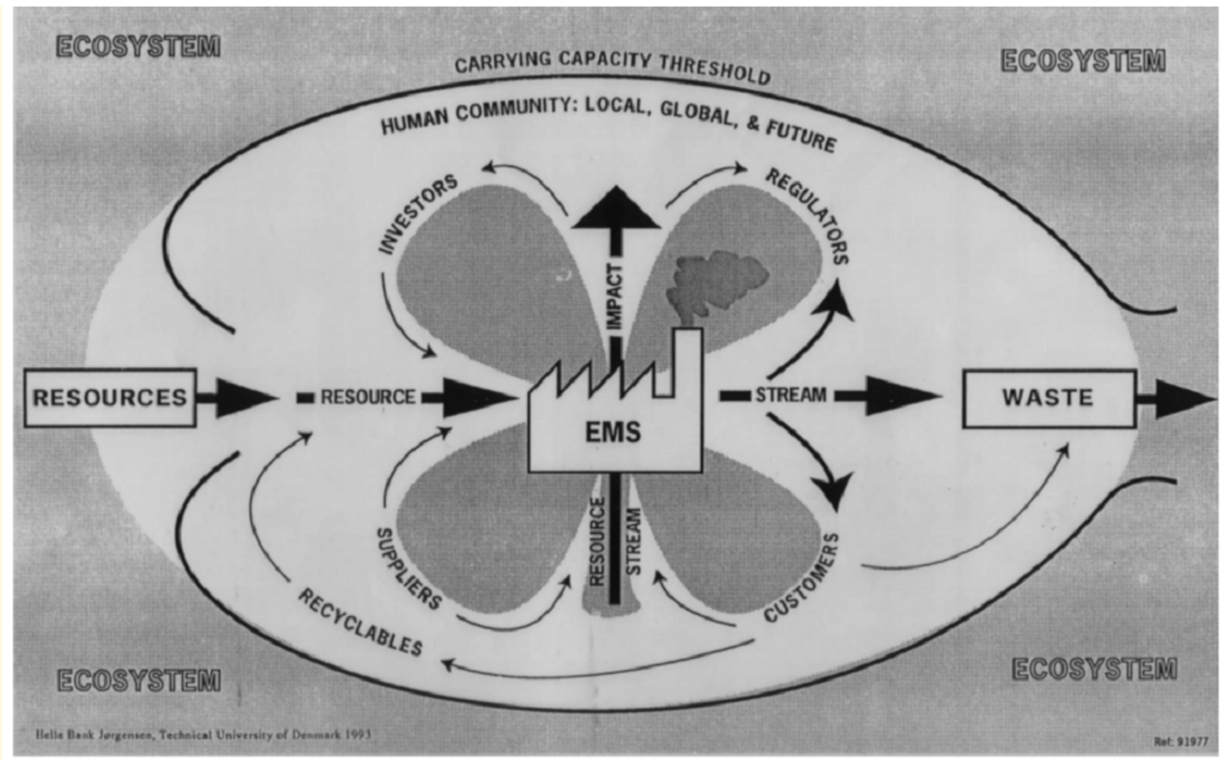


Figure 4-16: Coverleaf Model of Sustainable Industrial Development
This is a reprint from an article whose final and definitive form has been published in Social & Environmental Accountability Journal © Social & Environmental Accountability Journal Copyright Taylor & Francis; Social & Environmental Accountability Journal is available online at: http://www.tandfonline.com/doi/abs/10.1080/0969160X.1993.9665777
(Jorgensen, 1993, Fig.1 p.6)

+

SUSTAINABLE DEVELOPMENT

–

Resource Flow	Resource Flow Impact	Stakeholder Analysis	Carrying Capacity Assessment
# Integrated with Management Information System.	# Integrated with Management Information System.	# 100% Support	# Mature sere.
# Comprehensive Eco-balance.	# LCA directs Product & Process Redesign	# Pre-consultation.	# Biodiversity enhanced.
# Partial & ad-hoc Eco-balance. Used in EMAS & ISO standards.	# Environmental Impact Appraisal. Ecolabeling standards achieved.	# Reporting with consultation after the event. Agenda 21 involvement.	# Biological conservation.
# Waste Minimisation	# Supplier screening with material substitution .	# Reporting without consultation.	# Indicator species monitoring.
# Good Housekeeping & Energy Management.	# Customer or final use analysis.	# Recognition with some education and training.	# Critical load assessments.
# Stock and/or Work in Progress control.	# No Recognition.	# Recognition of economic stakeholders only.	# No Recognition of Ecosystem Limits.

★ Stars are awarded at any appropriate level for independent attestation.
Stars are obligatory to enter the highest level of the matrix.

Table 4-20: Sustainable Development Assessment Matrix

Draft benchmarks shown in table cells for illustration. This is a reprint from an article whose final and definitive form has been published in Social & Environmental Accountability Journal © Social & Environmental Accountability Journal Copyright Taylor & Francis; Social & Environmental Accountability Journal is available online at: http://www.tandfonline.com/doi/abs/10.1080/0969160X.1993.9665777 (Jorgensen, 1993, Fig.2 p.6).

Natural Capitalism Context Model

In the late 1990's Senge working with a number of colleagues started work on a book which was not subsequently published. The draft continued the most detailed and rigorous depiction found of the eco-system service and other flows of biophysical stocks related to (manufacturing) business, the key context for any business design. Hence its inclusion here as Figure 4-17.

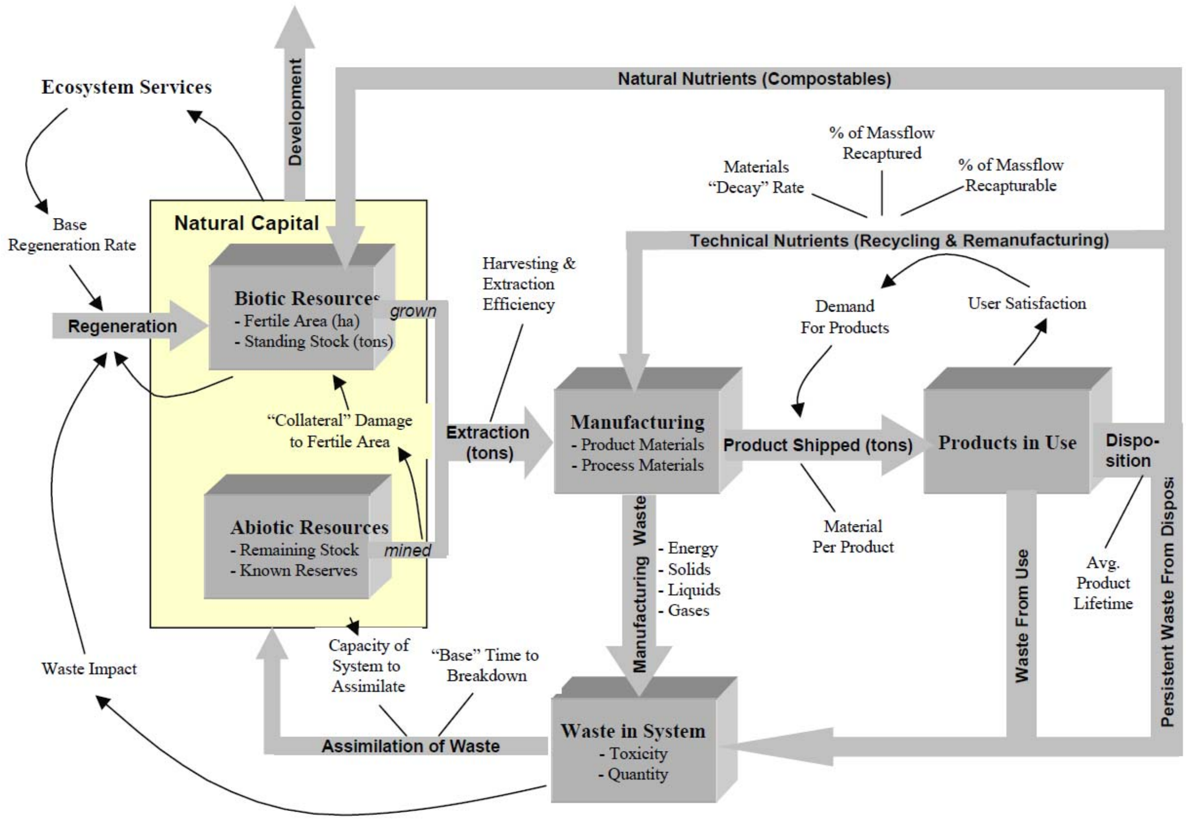


Figure 4-17: The Natural Capitalism Context Model of Sustainable Organizations
(Senge, Seville, Lovins, & Lotspeich, 1999, p.6)

Sustainable Strategic Management Model

Of the less detailed models found Stead and Stead's sustainable strategic management model appears to integrate all the key elements of strong sustainability at a strategic level. This is shown in Figure 4-18.

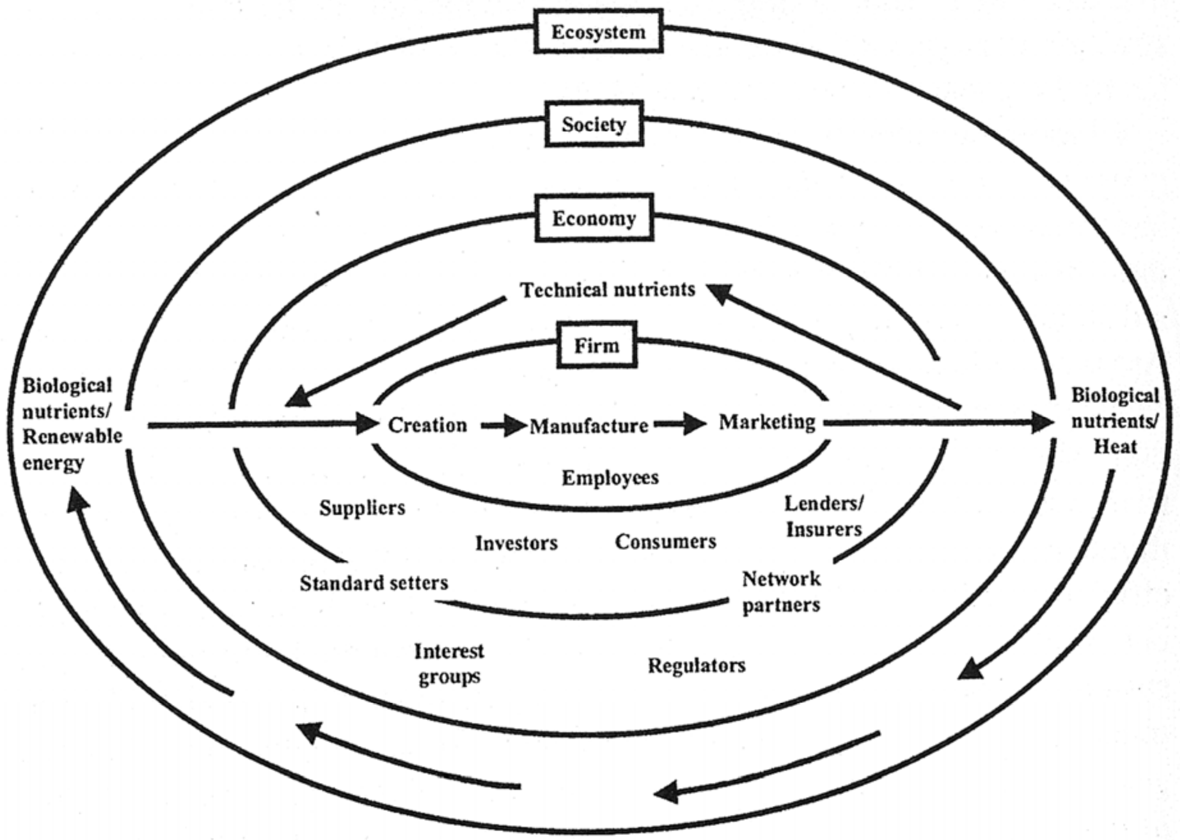


Figure 4-18: Sustainable Strategic Management Model Closed-Loop Value System
(Stead et al., 2004, Fig. 5.3 p.84. Copyright © 2004 by M.E. Sharpe, Inc. Used by permission. All Rights Reserved. Not for reproduction)

CQI Model of the Sustainable Organization (MoSO)

The Model of the Sustainable Organization (MoSO) was developed by a working group of the UK Chartered Quality Institute (CQI). The CQI is a non-profit organization focused on the support and promulgation of Dr. Edwards Deming's work on Total Quality Management.

Leveraging the systems and process oriented work on total quality from Dr. Deming (Aguayo, 1990; Deming, 1986) the MoSO model provides an operational business process and continuous improvement view of strong sustainability. This is shown in Figure 4-19.

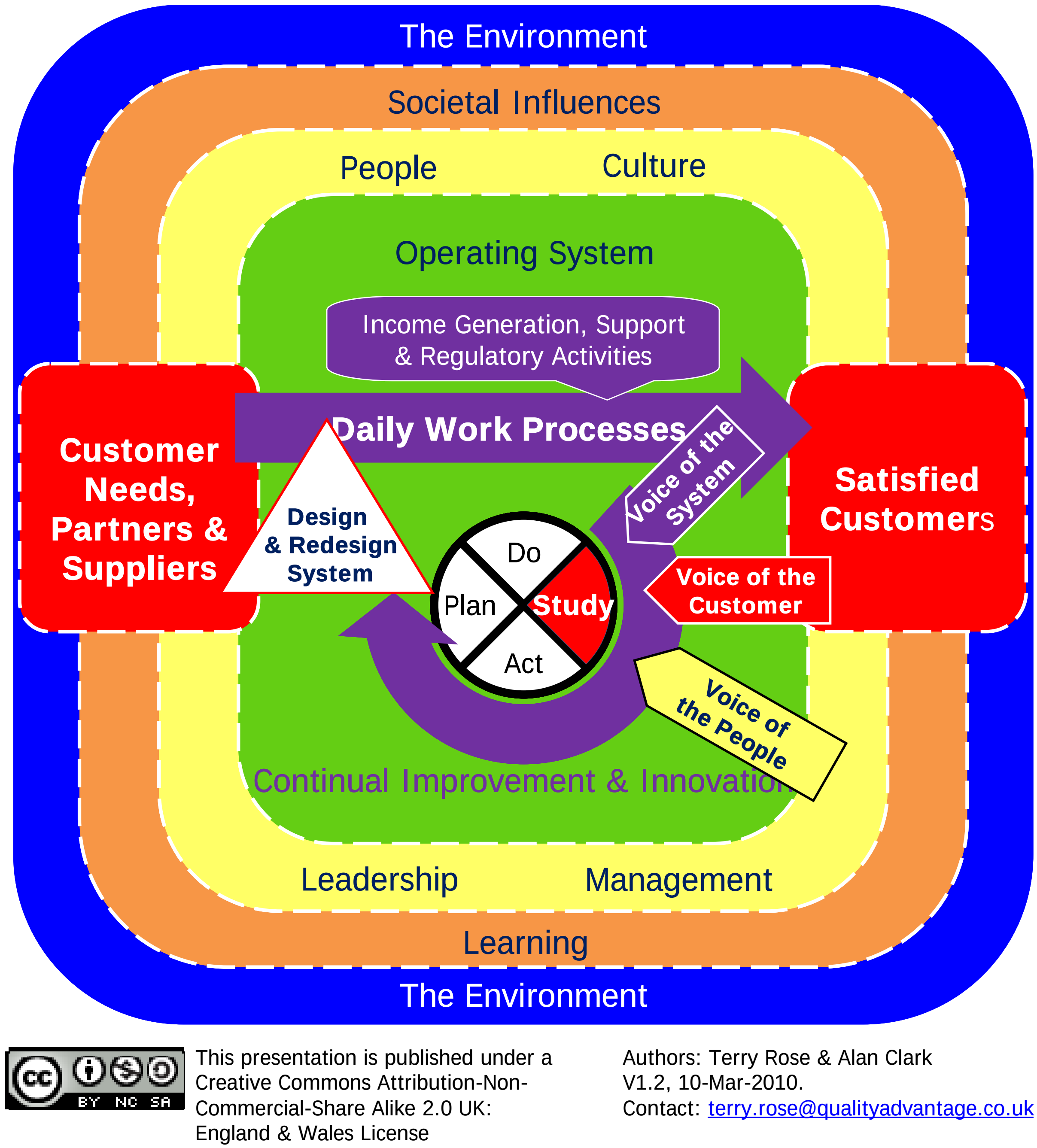


Figure 4-19: CQI Model of the Sustainable Organization
(A. Clark, Rose, Richings, Gall, Peterson, Korycki, Hodges, Ridsdale, Upstone, Pollard, Aitken, Hiscock, Charlton, & Brown, 2009,2010,2011a)

We Are Arising Sustainable Business Model

Following completion of the Master's program inspired by the work of Dr. Karl-Henrik Robèrt[76], Andrew Outhwaite from Australian consultancy We Are Arising adapted an pre-publication version of Osterwalder's Business Model Canvas (Osterwalder, 2010, 2011) to include the four biosphere systems conditions. This work was intended to be presented at a conference with Osterwalder in the UK, although it is not clear if this conference ever actually occurred.

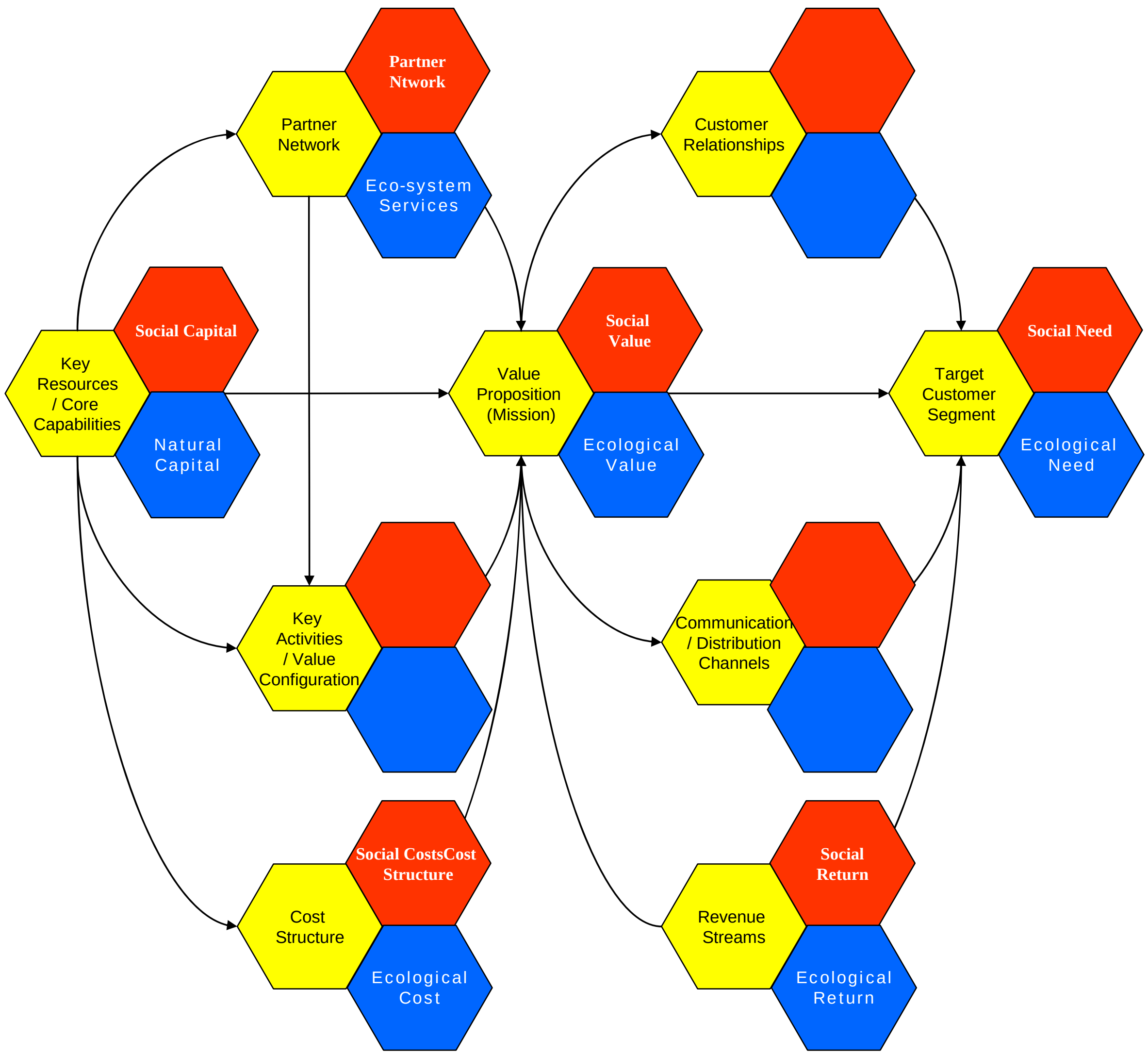


Figure 4-20: We Are Arising Sustainable Business Model
(Assembled from Outhwaite, 2009, Slides 9-13)

[76] Master's in Strategic Leadership towards Sustainability (MSLS) programme http://www.bth.se/ste/tmslm.nsf/pages/msls_home

Figure 4-20 shows Outhwaite's adaption of the Osterwalder's 9 box business model canvas (yellow boxes with light black san-serif text) by adding 9 additional corresponding boxes for each of the concepts from the environmental (blue boxes with white heavy/bold san-serif text) and social perspective (red boxes with white light serif text). Other visualizations that accompany this diagram indicate that Outhwaite understands the nested nature of the economi), social and environmental layers.

It does not appear that this work has been further elaborated, although a number of examples of its use are provided. These include descriptions of a business model of a green building, newspapers sold by the homeless and a shoe remanufacturer. The example descriptions also show natural and social capitals (left side of diagram) and social sources of revenues (e.g. charitable donations).

Spark Studio Sustainable Business Model

Bart Jansen from Belgian business innovation agency Spark Studio made a simple addition to Osterwalder's completed business model canvas (Osterwalder, 2010, 2011) based on a summary idea included in Osterwalder's popular book (Osterwalder & Pigneur, 2009, p.265) to capture non-monetary benefits that might arise from a business model. This is shown in Figure 4-21 by the addition of two boxes at the bottom of the figure to Osterwalder's 9 box canvas.

It appears that James Cox from the international NGO WorldVision Australia independently came up with the same addition to Osterwalder's canvas.

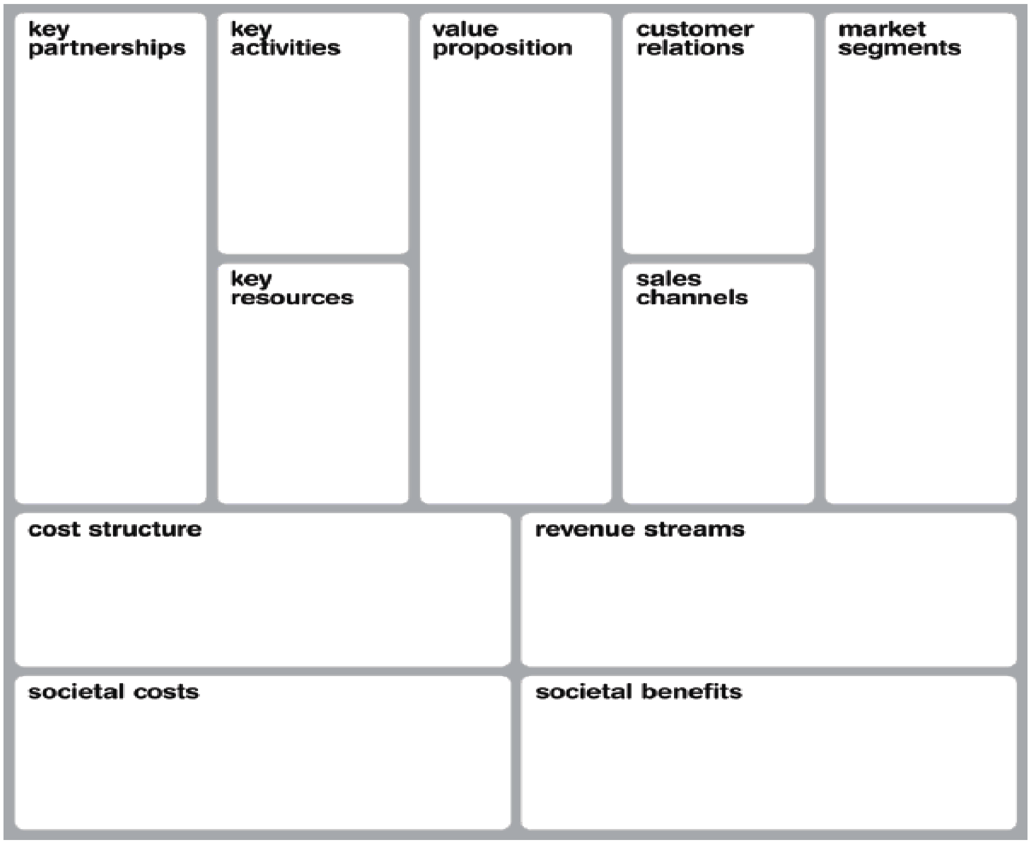


Figure 4-21: Spark Studio Sustainable Business Model
(Jansen, 2012, Slide 13)

Shift Alliance Business Modelling Tool

Benefit Corporation consulting firm Shift Alliance developed their business modelling tool, crediting Osterwalder as inspiration for the basic idea. This is shown in Figure 4-22.

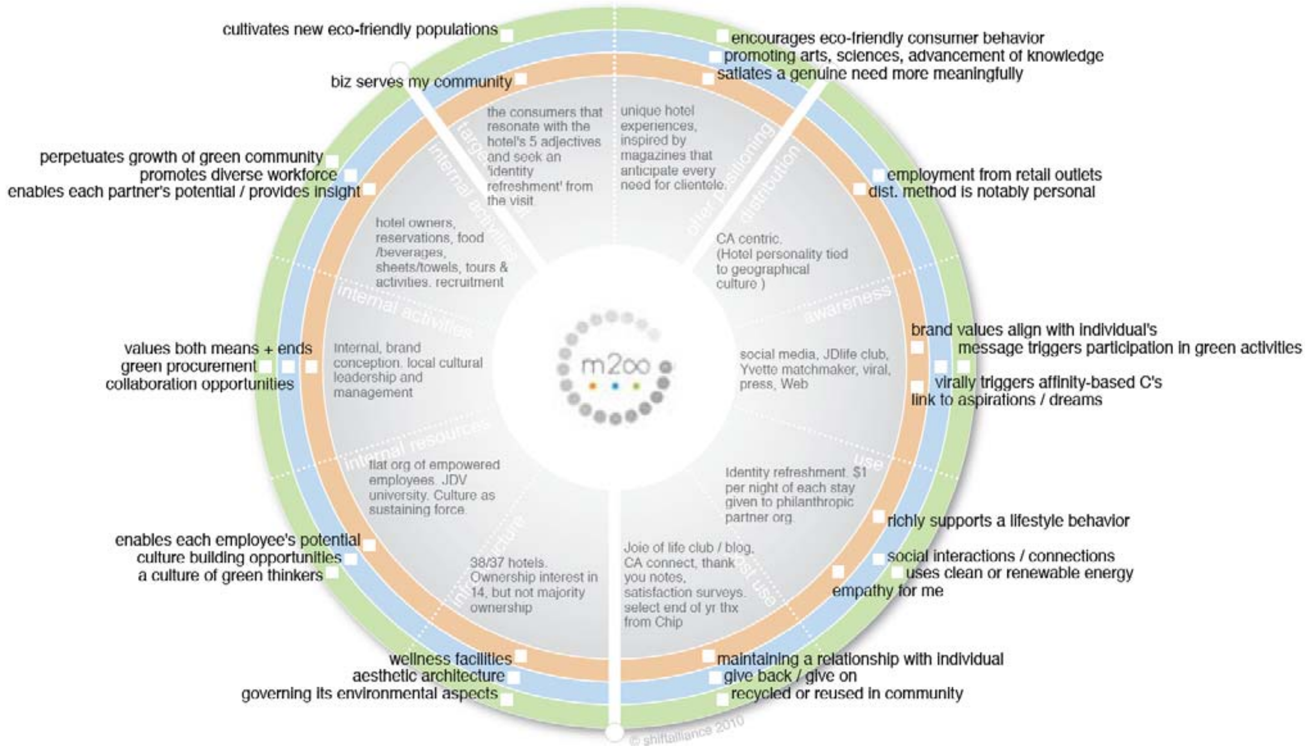


Figure 4-22: Shift Alliance Business Modelling Tool
(Parsey & Topp, 2010, p.44)

However, while a number of the concepts from Osterwalder's BMC are included in the inner-most ring, this model is fundamentally different from Osterwalder's. The firm whose business model is being designed is the central grey ring. Each of the three surrounding concentric rings considers, from innermost to outermost, how the firm creates meaning for individuals, communities and the environment respectively. Shift Alliance suggests that by ensuring firms maximizes the creation of meaning in these three dimensions maximizes overall sustainability: hence the label at the centre of the figure: Meaningful To Infinity (Individuals, Community, Environment).

SBSA Partners Adaptive Business Model for Sustainability

Sustainable Business Strategy and Architecture Partners (SBSA) is a U.S. based consultancy whose principles have 30 years of management information systems application and enterprise architecture experience.

In 2010 Laverdue and Conn published a white paper "improving business sustainability: adaptive [management information] systems to fit the rapidly changing business environment. Similar to Melaragno's white paper for the Business Architecture Guild, published in the same year (Melaragno, 2010), Laverdure and Conn apply their MIS perspective to the wider topic of business sustainability.

However, Laverdue and Conn go beyond Melaragno by developing a detailed model of sustainable business to help their clients understand the changes to a profit-first view of a business. This is shown in Figure 4-23.

While from the figure it is not clear if they have conceptualized strong sustainability, other tables and notes in the accompanying 26 page white paper make it clear the above model of a business is conceptualized within the fundamental limits of the nested systems of the economy, society and the environment.

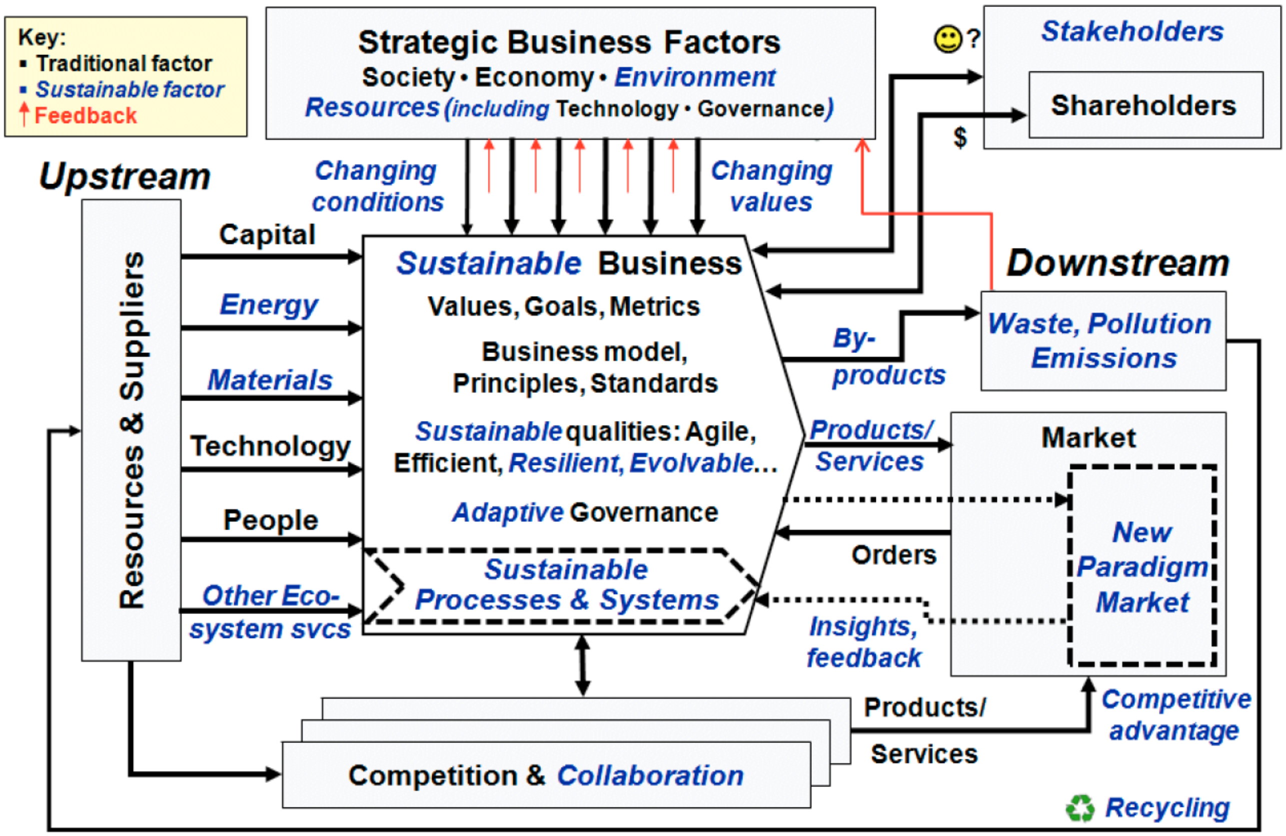


Figure 4-23: SBSA Partners Adaptive Business Model for Sustainability
(Laverdure & Conn, 2010, Fig.8 p.15)

4.6.5.10 Concluding Remarks on Strongly Sustainable Business Model Literature

As noted in introducing these works, there appears to be a general lack of rigor in the development and explanation of these models. Most were developed to help consulting companies sell services related to sustainability; it is unclear if they have been formally evaluated or are actively in use to describe or design strongly sustainable business models.

That academically defined business models of strongly sustainable business were not found lends support to the gap identified by this research (2.1), its goal, and the validity of the rigorous approach adopted in this research.

4.6.6 Strongly Sustainable Business Model Ontology Detailed Design Principles

The review of the strongly sustainable literature above appears to lend considerable support to DDP2 (conceptions of a business model) and DDP3 (boundaries of a business model). It also provides considerable additional detail to DDP2. Some alternative and/or complementary ideas concerning the concepts within a business model (DDP4) are also observed. This additional detail is captured in an additional detailed design principle.

DDP6: Concepts within a Business Model (Strongly Sustainable)

The SSBMO must be able to describe businesses that define and measure success as a result of a dialog between all its stakeholders, with their diverse needs and satisfiers from which they each derive value (i.e. the SSBMO must be able to describe tri-profit: the strongly sustainable conception of profit).

This implies that since:

- Such dialog is unlikely to result in the dissolving of all the stakeholders incommensurable needs and satisfiers, the SSBMO must be able to describe how the organization meets needs (value creation / positive value propositions) and how it fails to do so (value destruction / negative value propositions).
- Stakeholders will always be in dialog (value is not static, being based on mutable world-views), the SSBMO must be able to describe:
  - Which stakeholders are to be involved in which conversations (decisions)
  - What value is to be created / destroyed for which stakeholders (value propositions) and
  - How that value is to be created and destroyed (process).
- Stakeholders will measure success in different units, not just monetary, the SSBMO must be able to define and measure tri-profit using a multi-dimensional set of units of flourishing (economic, social, environmental), including money.

In turn, this suggests that in designing a strongly sustainable business model it is critical to understand, and hence the SSBMO must be able to describe:

- Who are the actors and what are their fundamental needs, from which the organization may or may not choose to acknowledge as legitimate stakeholders? Actors include: individual humans, collections of humans (firms, NGOs, governments, etc.) and non-humans.
- Which actors are acknowledged as playing one or more legitimate stakeholders roles and which sub-set of each actors' needs are satisfied (or left unsatisfied) by organizations' (positive and negative) value propositions.
- What are the steps by which environmental, social and economic positive value (revenues) and negative value (costs) are determined (valuation method).

Finally, the SSBMO must be able to describe:

- The relevant portions of business models of firms in their network that include all ultimate stakeholder's needs and all connections to the ultimate sources and sinks of all biophysical materials (firms).
- The geographic location and locality of any and all bio-physical components of a business model.

4.7 Results of Preparation

4.7.1 Introduction

This chapter defined the research design for the preparation activity stream and presented the results of activity group P4: a traditional and systematic literature view, and concluded with the choice of the detailed design principles for the SSBMO (DDP1..6). These complement the overall design principles chosen in Chapter 3 (ODP1 & 2).

As an aide memoire a 4 page summary of key elements created during the Preparation activity stream was prepared. This consisted of the research question (RQ), research objectives (RO0-2), definitions of profit-first and strongly sustainable organizations, overall design principles (ODP1 & 2), definitions of value, the ontology detailed design principles, including the definition of a strongly sustainable business model (DDP1-6) and the canvas design principles (CDP1-3, defined below in 4.7.4) (Working Paper #3).

4.7.2 Towards a Theory for the Conditions Required for Strongly Sustainable Organizations

4.7.2.1 Introduction

During the traditional and systematic literature reviews of all the relevant shared (K0), profit first (K0-PF) and strongly sustainable (K0-SS) formal, natural and social science literature undertaken during the Preparation activity stream a pattern of observations and recommendations was noticed in the literature.

Upon further reflection this pattern appeared to indicate that many natural and social scientists have a common understanding of both the biophysical conditions and the shared and individual world-views that must be held in order for strongly sustainable organization to come into existence.

Although all the material to support the argument being put forward by these scholars is described in Chapters 1 thru 4, the argument itself has not been highlighted. Together this argument points towards a Theory for the Conditions Required for Strongly Sustainable Organizations to come into being, i.e Organizations which meet the working definition derived in 3.5.3.4 A Definition of Organizational Strong Sustainability:

> A strongly sustainable organization is one in which all of its behaviours and all the behaviours of all other relevant social, economic and biophysical actors, lead to the possibility that human and other life will flourish on the planet forever

Suggesting such a inter- or possibly trans-disciplinary theory for the pre-conditions required for organizations to exist that meet this definition is believed to be a contribution of this work; presenting the argument in support of this possible theory is the purpose of this section. However, much work is required to confirm the validity of this thesis. See the proposed research agenda for more discussion on the possible approach to close this theoretical gap and subsequently justify this theory (Chapter 11).

The argument in favour of the theory is organized and presented in the same order used for the systematic literature review (Table 4-2) and draws upon material from all three of the world-views: shared (K0, 4.4), profit-first (K0-PF, 4.5) and strongly-sustainable (K0-SS, 4.6). These sections should be consulted for the references to the sources from which each element of the argument is made.

4.7.2.2 Definition of Planetary Conditions for Strong Sustainability

First: In order to understand the conditions required for strongly sustainable organizations to be possible groups and individual humans need to have a shared understanding of what planetary strong sustainability means. **(TSSO1)**

Specifically groups and individuals need a common understanding of the formal, natural and social science of the reflexively connected biophysical environmental, human social and monetary economic aspects and conditions for strong sustainability.

At present such a inter- / trans- disciplinary shared understanding does not exist – academically and in practice. However a theoretical understanding and appreciation of planetary conditions for strong sustainability can clearly be developed, informed by normal and paradigm changing science in all disciplines[77].

Summarizing the scholarly works that clearly need to be a part of any such understanding is believed to be a contribution of this work.

[77] The difficult involved in such an effort should not be understated: Karl Henrick Robèrt attempted to undertake this work in the late 1980's (See Footnote 17). He failed due to his inability to gain consensus across the disciplines. However, he was able to gain consensus on the planetary system conditions that must ***not*** be breached for strong sustainability to be possible: this lead to the creation of the Framework for Strategic Sustainable Development (4.4.3.2).

4.7.2.3 Personal World-View Compatible with our Scientific Knowledge of Strong Sustainability

> **Second**: To act upon our understanding of the planetary conditions for strong sustainability requires certain individual and collective world-views (i.e. belief systems that cause people to consistently act in accordance with those beliefs) **(TSSO2)**.

It appears highly unlikely that a theoretical planetary understanding of strong sustainability can be acted upon by groups and individual humans with the (predominately profit-first) world-views held by groups and individual humans (at least in the Global North).

These predominant world-views create significant personal and collective barriers for humanity to choose, as a primary macro-goal for society, the flourishing of human and other life and then consistently acting locally in alignment with this goal and the theoretical planetary understanding of strong sustainability[78].

For example at present it is hard to imagine that national, regional and local government, multi-national, national and local firms and NGOs, families and their members could consistently act in adherence to the "Natural Laws of Sustainability" (Table 4-13). And yet, much of the literature reviewed implicitly or explicitly suggests that consistently following such laws is required to create the planetary conditions required for strongly sustainable outcomes to consistently emerge.

4.7.2.4 Macro-Socio-Economic Goals Compatible with Strong Sustainability

> **Third**: To consistently act in alignment with these world-views requires a new macro-socio-economic goal for society; or at least people willing to act to achieve this goal even if 'official' policy is not aligned with It **(TSSO3)**.

---

[78] One group impacted by this barrier are the scholars who would need to collaborate on the normal and paradigm changing formal, natural and social science required to define the planetary conditions for strong sustainability (4.7.2.2)! Thus there is a reflexive relationship between the need for compatible world-views and our ability to define and act on any understanding of the conditions of planetary strong sustainability.

Achieving a societal macro-goal of the flourishing of human and other life is not possible through the pursuit of the macro-economic policy of GDP growth and all its supporting policy and legal frameworks.

The pursuit of these policies clearly does not reflect the biophysical limits of the planetary systems upon which current life depends. Further many of these policies create and / or fail to solve social barriers and / or environmental conditions that are known by science to directly lead to the death, survival or languishing of human and other life.

4.7.2.5 Micro-Socio-Economic Goals Compatible with Strong Sustainability

Fourth: To achieve this new macro-socio-economic goal will require a reconceptualization of organizational success and its measurement from solely the maximization of monetary profit to the integrated achievement of tri-profit **(TSSO4)**.

Macro-socio-economic policies designed to directly achieve the flourishing of human and other life will not succeed if the purpose of human organizations and the measurement of its achievement are not aligned.

Existing profit-first conceptions of organizational purpose and measures of its achievement, including pluralist conceptions, are at best insufficient and at worst harmful to achieving a macro societal goal of flourishing[79].

The acceptance and operationalization of conceptions of what here has been termed tri-profit is required for organizations to be able to design and pursue goals that are simultaneously aligned with: first the understanding of planetary strong sustainability (TSSO1), second

[79] While this is easy to understand for monetarily for-profit firms, it is also true for NGOs (who must generate a net monetary profit of zero), households, individuals and even governments. It is currently considered good practice for households, individuals and governments at all levels to have a 'balanced budget" (i.e. a net monetary profit of zero). Ecological economists have suggested at least for governments that have control over the creation of monetary units this is not only not necessarily but makes policies designed to achieve flourishing within a steady-state economy more difficult or impossible to pursue (T. Jackson, Daly, Speth, & Korten, 2011; Lawn, 2010).

world-views compatible with strong sustainability (TSSO2), and third a societal macro-goal of the flourishing of human and other life (TSSO3).

4.7.2.6 Business Model Designs Compatible with Strong Sustainability

Fifth: To design and instantiate organizations that can reliably achieve tri-profitability requires the use of compatible theories, practices and patterns of strategy, business model design, operations and measurement **(TTSO5)**.

Achieving organizational goals measured through the maximization of tri-profit within planetary limits is unlikely to be achieved through the application of theory and practice created within the existing machine age profit-first paradigm and the macro-socio-economic goal of GDP maximization.

Instead theories and practices of organizational design and operations that explicitly consider the integrated goals of tri-profit within planetary limits are required.

This theory and practice must of necessity be aligned with the planetary understanding of strong sustainability whose outline is sketched in Chapters 3 and 4. For example a business model designer who is intending to design a strongly sustainable business model should ask themselves the series of questions about their business model design based on the formal, natural and social science of organizational strong sustainability, which are embedded within the SSBMO through its adherence to the ontology and Overall and Detailed Design Principles (ODP1 & 2, DDP1-6).

The SSBMO does not provide the possible answers to these questions; but clearly it would make the SSBMO more useful if the range of possible answers which complied with the formal, natural and social science of organizational strong sustainability were available to a business model designer. The possible answers could be referred to as Strongly Sustainable *Business* Design Principles.

The theory of strong sustainability reviewed from the literature in Chapters 3 and 4 that led to the derivation of the ontology Overall and Detailed Design Principles is conceptually proximate to any strongly sustainable business design principles. Clearly, such principles need to be derived from the same literature for them to be compatible with the SSBMO (as well as valid, assuming the legitimacy of the literature reviewed and the design principles chosen). Given this conceptual proximity, the nature of possible Strongly Sustainable Business Design Principles was a natural reflection during this research. Hence, to act as a platform for further research and practice some initial hypothesis for these design principles have been derived. These are provided in 7.6, referred to as *proto*-Strongly Sustainable Business Design Principles[80].

4.7.2.7 Taking Action Today

Of course any persons or groups whose world-views align with the "Natural Laws of Sustainability" (Table 4-13), that live in societies which permit sufficient personal freedom of thought and action, and who wish to act in according to the current formal, natural and social scientific understanding the planetary conditions of strong sustainability and a macro-social goal of flourishing, may choose to act accordingly now.

Many of the organizations listed in 4.3.2.3 are examples of the many current best effort attempts at such aligned actions. This thesis and the work planned to bring the SSBMO into wide-spread use is another example.

4.7.3 Ontology Detailed Design Principles

The Ontology Overall and Detailed Design Principles (ODP1 & 2, DDP1-6), derived in Chapters 3 and 4 from the traditional and systematic literature reviews, are aligned with the above proposed theory for the conditions required for strongly sustainable organizations. It is hoped, as per the research question and objective (RQ, RO1 & 2), that these principles provide one very small part of the conditions for strongly sustainable outcomes to emerge.

---

[80] Recently Dr Bob Willard, The Natural Step Canada and B Lab have started to refer to the Strongly Sustainable Business Design Principles as a component of a "Gold Standard" for organizational sustainability (The Natural Step, 2013). The author is engaged in work with these individuals and groups in creating such a standard, which would include the business design principles, metrics for the measurement of their achievement and threshold values of the metrics that determine the minimal level of adherence to the principles that would allow a business to claim it was sustainable. This literature review is one input to this effort.

If valid, **any** ontology of business models that fully adheres to these design principles should, if used by persons with world-views well aligned with the "Natural Laws of Sustainability" (Table 4-13) to design business models and subsequently create operating firms following these models, help to create the conditions from which strongly sustainable outcomes may emerge.

To summarize, Table 4-21 lists the SSBMO detailed design principles (DDP1..6). These will be used to guide the design of the SSBMO. The methodological approach to: ensuring the SSBMO adheres to these design principles is described in Chapter 5 and to evaluating its utility in light of these design principles is describe in Chapter 6. The design of the SSBMO (and the SSBMC is powers) which is believed to adhere to these design principles is described in Chapter 7.

DDP #	**Detailed Design Principle**	**Originating World-View**		
		Shared (K0 4.4)	**Profit First** (K0-PF 4.5)	**Strongly Sustainable** (K-SS 4.6)
1.	Diagrammatic Formalism	✓		
2	Conception of a Business Model	✓		
3	Conceptions of Boundaries	✓		
4	Timeframe for Validity	✓		
5.	Concepts within a Business Model (Profit-First)		✓	
6.	Concepts within a Business Model (Strongly-Sustainable)			✓

Table 4-21: Summary of Ontology Detailed Design Principles

The world-view of the person reading these detailed design principles will clearly influence the validity or relative importance with which each principle is held. Further, the world-view will shape which paradoxes the reader might find between design principles. This is to be expected given the contradictions in the key theoretical frames reviewed to derive the detailed design principles. Ultimately it will be the user of the ontology when describing or designing their business model to resolve these paradoxes based on their world-view (as per ODP2).

4.7.4 Canvas Design Principles

Based on the exemplar researcher's discussion of the value of visual design tools (see 3.5.1.3 Exemplar Organizational Ontologies Use as Tools and Exemplar Organizational Ontologies Visual Design), the detailed design principles of the SSBMC are:

CDP1: the SSBMC will be compatible with, conceptually 'powered by', the SSBMO, i.e. similarly to SSBMO, the SSBMC embeds the best current natural, social and formal scientific knowledge of what best enables strongly sustainable outcomes to emerge from human organizations while taking an empathetic response to users with a range of world views from profit-first to strongly sustainable.

CDP2: the SSBMC will be straight forward and attractive to use.

CDP3: the SSBMC will enable business model designs of high quality to be produced with reasonable effort.

4.8 Support for Working Hypothesis

This chapter closes with a revisiting the working hypothesis established in 2.4 in light of the findings from the literature reviews conducted during all the preparation activities P1-7 (Figure 4-1)

Working Hypothesis	Overall Comments in Light of Literature Reviews
WH1. A model of business that can be used to describe designs of sustainable business can be built from existing knowledge of business models and sustainability.	The quantity and quality of the literature found suggests this hypothesis is true.
WH2. Current conceptions of business models are largely inadequate at conceptualizing sustainability.	The differences identified between the profit-first, ecological modernist and strongly sustainable conceptions of business model suggests that both the former have difficulty conceptualizing strong sustainability.
WH3. A model of sustainable business is perceived by managers as having validity and value. The model delivers value by allowing managers to understand gaps in their organization's approaches to increasing sustainability (these gaps vary between organizations, and by groups of organizations – such as firms in a particular sector; the are many reasons for these gaps)	The existence of a flourishing stream of research and practice suggests managers believe, generically, business models can be valid and have value.
WH4. A good starting point for helping managers increasing the sustainability of their organizations is to highlight gaps between current business design and potential future business design(s) and then identify the reasons for those gaps.	The literature suggests that a generic benefit of business models is that they can help managers understand gaps between current and future business designs and the reasons for those gaps.

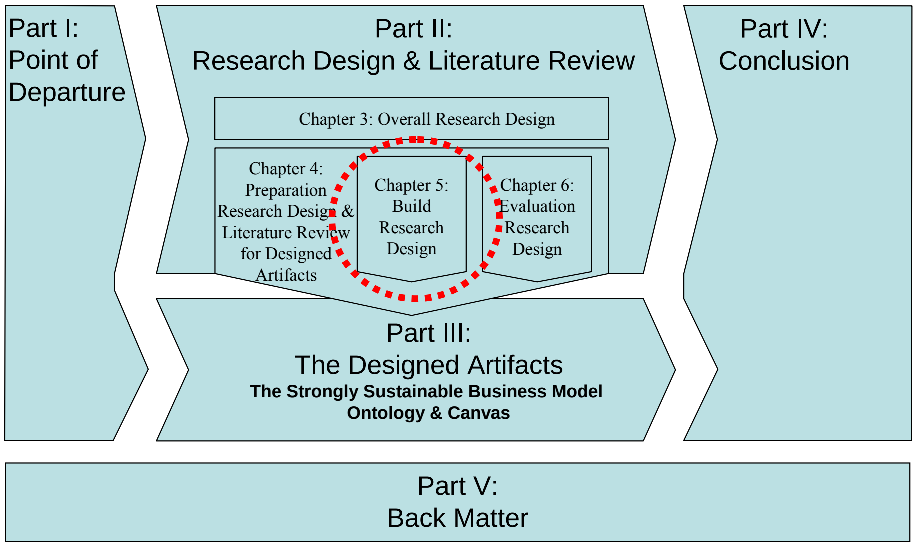
Table 4-22: Support for Working Hypothesis in Light of Literature Reviews

4.9 Summary of Preparation Detailed Research Design.

A summary of the preparation activity stream detailed design is provided in Table II-1, at the end of Part II (after Chapter 6).

Chapter Five: Build Research Design

Ah, to build, to build! That is the noblest of all the arts — Henry Wadsworth Longfellow



Within the context created by the overall research design set out in chapter 3 and the detailed design principles developed from the key theoretical frames in chapter 4, this chapter determines the detailed research design for the build activity stream that creates the SSBMO artefact and the SSBMC it powers. This is required to identify and plan the execution of the specific methods and techniques to be used to ensure rigour in the execution of the build activity stream and the creation of the artefacts.

This chapter once again applies the three steps set-out at the start of part II. The search (A) of the literature is presented that describes research designs for (approaches to) building artefacts in the three research fields upon which this research draws and integrates: ontology engineering, design science and systems research. From this search a reflection (B) that applies (C) the choices made to design the details of the build activity stream of this research is presented.

5.1 Introduction

This chapter describes the creation of the build detailed research design. In doing so this chapter describes a set of choices that contribute to the meeting of the research objectives (see 3.6.6) by responding to the question:

> How to best undertake the build activity stream with the greatest rigour possible in order to create artefacts with the highest utility in light of the research objective?

To answer these questions the three steps set-out at the start of this part (A-Search, B-Reflect, C-Apply) are used repeatedly.

These steps are used to operationalize the parts of the systemic design science methodology relevant to the build activity stream described in Chapter 3 (3.5.4).

5.1.1 Chapter Structure

Recalling the three steps (A-Search, B-Reflect, C-Apply) set-out at the start of Part II to increase research rigor by making explicit the choices made in this research, this chapter is structured as follows:

- Section 5.2 describes a search of the literature related to the process, methods and techniques for the build of design science research outputs (i.e. constructs, models, instantiations and methods).
- Section 5.3 describes the reflection on the choices necessary to design the build activity stream, based on the literature reviewed in section 5.2 and the overall approach to systemic design science research (3.5.4).
- Sections 5.4 thru 5.8 describes the details of the build research design as follows:
  - Section 5.4 introduces the activity groups within the build activity stream, including their inputs and outputs.

- Sections 5.5 thru 5.7 describe the first three build activity groups that iteratively build the SSBMO and the SSBMC it powers. The results of undertaking these activity groups is presented in Chapter 7.
- Section 5.8 describes the final build activity group that lays the ground for improvements to the SSBMO and SSBMC based on the results of the evaluation activity stream (Chapter 6 describes the evaluation activity stream, Chapter 8 its results).

- Section 5.9 concludes by summarizing the build detailed research design.

5.2 Searching for Best Practices to Undertake Build

Analysing the literature on how to 'best' build artefacts in systemic design science research has uncovered a limited literature. This compares to the considerable body of literature on both the overall process of designing (Chapter 3), and the smaller bodies of literature on the processes of preparing to design (Chapter 4) and evaluating designed artefacts (Chapter 6).

This is perhaps unsurprising given that at the heart of building (designing) anything is the mental process of abduction: informed guessing (3.2.2). Other than maximizing the degree of being informed via rigorous preparation, there is perhaps little other overall advice in the literature. This aligns with the overall approach to achieving rigour in this research (II-2), and the approach taken to rigorously become informed through the out of the preparation activity stream: the derivation of the overall and detailed design principles and research design from the relevant key theoretical frames (Chapter 3 and 4).

Thus, compared to the depth and breadth of the literature reviewed supporting the detailed design of the preparation and evaluation activity streams, the search of the literature for build best practices will appear abbreviated. Summarizing all the systemic design science literature, rigor in the build activity is determined by the rigour and thoroughness of the researcher's preparation. In this case the preparation is encapsulated in and made easy to use during the build activity stream by the use of the design principles (ODP 1 & 2, DDP1-6, CDP1-3) (Chapters 3 and 4).

5.2.1 Reviewing the Literature

However, even given these slight expectations, with the objectives of this research in mind and in the context created by the design principles, this section reviews the literature related to the creation of:

- Ontologies and other Information Systems artefacts (from Ontology Engineering, Management Information Systems and Computer Science),
- Design science artefacts (from Design Science)
- Organizational ontologies that have been produced through design science research (e.g. the exemplars introduced in 3.5.1.3), and
- General requirements and specific solutions (from Soft Systems Methodology Research, as shown in Figure 3-13).

This section is organized as follows:

1. Definitions of and broad purposes on building artefacts are reviewed.
2. Views on the processes that can be used to build artefacts are discussed.
3. The inputs of knowledge required to build artefacts subsequently evaluated as having high utility are described.
4. The methods and techniques that may be used to build artefacts are described.
5. The representation of information systems artefacts is discussed.

The next section (5.3) describes how the build detailed design for the SSBMO was chosen based on a reflection and application this literature. Subsequent sections (5.4-5.8) provides the details of the chosen build detailed research design.

5.2.2 Building: A Definition

One can argue that the definition of the build activity within systemic design science is at the heart of this epistemology. Recalling Hevner's definition (3.4.1), design science:

> *Creates and evaluates […] artefacts intended to solve indentified organizational problems* (Hevner, March, Park, & Ram, 2004, p.77).

Having followed the literature's advice on preparation and created the design principles (Chapters 3 and 4) what remains for the build activity is the act of creation, i.e. to under take the design of the research output, the constructs and model that comprise the SSBMO artefact.

Building on the working definition of preparation, this leads to the following working definition:

> Build is that part of design in which a person informed on what is believed to be desired abducts an artefact intended to have high utility in fulfilling those desires.

5.2.3 Process of Building

This sub-section presents the results of a search the literature for advice on how best to undertake the process of building of an artefact.

5.2.3.1 Ontology Engineering

In one frequently cited early work providing guidance on methods to construct ontologies Ushold and Gruninger suggest that building an ontology comprises three steps: capture, coding, and integration with existing ontologies (Uschold & Gruninger, 1996, p.15)[1]:

- *Capture* is suggested to involve "1. Identification of the key concepts and relationships in the domain of interest; 2. Production of precise unambiguous text

[1] This builds on an early workshop convened by Uschold and King (Uschold & King, 1995).

definitions for such concepts and relationship; 3. Identification of terms to refer to such concepts and relationships" (p.15).

- *Coding* is suggested to involve consistently structuring the concepts and relationships and then representing the concepts and relationships using a (formal) language.
- *Integration* with existing ontologies (including wholesale reuse) is suggested to be possible during both capture and coding, and recommended in order to maximize utility (3.5.1.3 Benefits of Ontologies).

However, in their detailed advice on applying this approach to semi-formal ontologies, such as the SSBMO (3.5.1.5 Chosen Ontology Type), Ushold and Gruninger, without reason, are cautious about providing normative guidelines: "the emphasis here will be on *informal* techniques" (Emphasis in the original p.18)[2]. Their guidelines provide:

- Well known techniques for creative thinking: brainstorming and grouping/categorizing (p.19).
- The recommendation to identify which constructs are "fundamental, or basic […i.e. what is] the same for most people" (p.20).
- The recommendation to work "middle-out" (as opposed to top down or bottom up) from these basic constructs, suggesting this improves ontological quality while reducing the likelihood for rework (i.e. improved efficiency of ontology creation) (p.20).
- Advice on how define and label constructs and their inter-relationships and how to handle ambiguous labels for constructs (pp.22-24).

Other authors have taken up and elaborated on Uschold and Gruninger's advice for constructing ontologies in specific contexts (e.g. Noy & McGuinness, 2001).

[2] In this same article these authors reviews others techniques they suggest are appropriate for ontologies of the formal type to be used in computer systems (3.5.1.3 Types of Ontologies)

In their chapter on “Ontology Engineering Methodology” in the recent “Handbook on Ontologies” Sure et. al. include advice to “guide the initial set-up” of ontologies (Sure, Staab, & Studer, 2009). While their terminology is different (“kick-off” replaces capture and “refinement” replaces “coding”) it is clear that the approach is highly similar (pp.138-141).

Ramaprasad and Papagari in their 2009 DESRIST paper identify that analysis, which they refer to as decomposition and recomposition, can provide ontologies that are “meaningful, coherent and complete”. However they caution that an analytic approach to design may also result in meaningless, incoherent and incomplete ontologies, and advocate, using a range of examples, for an integration of analysis and synthesis in ontology construction (Ramaprasad & Papagari, 2009).

5.2.3.2 Management Information Systems

O’Leary suggests that the build of management information systems enterprise ontologies can be undertaken using Activity Theory and that through its inclusion of subjects (humans), objects and communities innovative artefacts can result (O'Leary, 2010).

5.2.3.3 Systemic Organization Design

In addition to supporting the basic approach taken in this research (creating design principles, setting boundaries, etc.) organization design researchers Romme and Endenburg suggest that iteration (which they refer to as “circular design”) improves the quality (reliability, consistency, effectiveness) of the artefact and the efficiency with which it is produced (Romme & Endenburg, 2006). Their review of the theory relies heavily on systems thinking, specifically cybernetics in order to establish their circular organizational design process (pp.290-291) and aligns well with the approach suggested by Gharajedaghi and Mienttinen (3.5.4.3).

5.2.3.4 Exemplar Organizational Ontologies: The Design Science and Ontology Engineering Perspectives

Reviewing the approaches to the build activity taken by the three exemplar organizational ontology researchers, introduced in 3.5.1.3:

- Osterwalder makes few comments about how he undertook the construction of the business model ontology. This is in contrast to the thoroughness with which he plans for the preparation (4.2.1.4) and evaluation activities (6.2.3.2) and subsequently documents his ontology. Osterwalder provides only the following details about his approach to building his ontology:

  – "The first research goal […] is to find an ontology" (p.5).

  – A model, the ontology, is defined that "expresses the business logic of a firm" (Figure 3, p.6).

  – Basic concepts, the constructs, for business models are found (Figure 3, p.6).

  – "Constructs, models, methods and artefacts are built to perform a specific task" (Osterwalder, 2004a, p.5).

  However, while not recorded in his thesis, it is clear from other materials produced during his PhD studies, that Osterwalder's build process went through a number of iterations of development. These involved both personal reflection on his literature review and a number of formal and informal workshops he organized with his supervisor and other business model scholars (Osterwalder & Pigneur, 2002; Osterwalder, 2002a; Osterwalder, 2002b; Osterwalder, Lagha, & Pigneur, 2002; Osterwalder, Gordijn, & Bouwman, 2004; Pateli & Giaglis, 2004).

- Bullinger appears to identify her "develop / build" stage from a syntheses of the ontology engineering literature, including those reviewed above. She suggests that in this stage "ontology elaboration starts" and that this consists of "three groups of activities: kick-off, knowledge acquisition and formalization" (Bullinger, 2008, p.238).

Supporting the approach taken in this research in both the overall research design (Chapter 3) and preparation detailed research design (Chapter 4), Bullinger suggests that the kick-off activity explicitly sets the purpose of the ontology, including the scope, classification, support activities, knowledge sources and stakeholders (pp.238-239).

The knowledge acquisition activity, also largely overlaps with this research's approach to preparation. Although Bullinger states that "knowledge acquisition is a continuous activity during the entire ontology lifecycle" she goes on to rationalize its inclusion as an early step of develop / build because "the decision on approach and method [to knowledge acquisition]" and the process of gathering "the majority of knowledge necessary" must occur early "to allow for a realistic conceptualization [of the built artefacts" (p.240).

Bullinger's formalization activity within her "develop / build" stage aligns directly with what in this research is referred to as the build activity stream. Bullinger states "the objective [of formalization] is to produce a mature, formal ontology". This is accomplished through an iterative process of increasing formalization and rigour (Bullinger, 2008, p.247). She goes on to discuss the importance of documenting each iteration thoroughly and contemporaneously (p.252).

Other than the citation of the ontology engineering literature Bullinger appears to makes little use of others work in determining her approach to formalization.

- As noted in Chapter 4 (4.2.1.4 Design Science and Ontology Engineering Responses) Al Debei does not identify a separate build activity, rather he integrates preparation and build in a single "analysis and design phase" consisting of three activities: knowledge acquisition, conceptualization, and visualization and formalization (Al-debei & Fitzgerald, 2009; Al-debei, 2010, pp.41-46). Also as noted earlier, visualization and formalization are clearly build activities, whereas knowledge acquisition and conceptualization appears to straddle preparation and build. In addition, due to the choice to formally represent his ontology in a computerised ontology-engineering support tool, Al-debei spends some time considering which tool to use and how to best use it to record his formalized ontology (pp.60-61).

Like Osterwalder and Bullinger, Al Debei takes an iterative approach to the development of the ontology. As also noted in Chapter 4, like Bullinger, Al Debei explicitly uses both library research and semi-structured interviews iteratively followed by induction, deduction and abduction to build the ontology during the knowledge acquisition and conceptualization activity.

The visualization and formalization activity then "provides an appropriate graphical representation and formalization of the conceptualized ontology" (p.59).

5.2.3.5 Systems Approaches

Within the systems thinking literature consulted, only one detailed piece of advice was found concerning how to approach the build process systematically and systemically. This advice, from Ghrajedaghi and Mienttinen concerned how to structure iteration, at any level of a research design or practitioner design process. As a result of its general applicability it was introduced in Chapter 3 as part of the overall approach to systemic design science adopted in this research (3.5.4.3, Figure 3-15).

Applying Ghrajedaghi and Mienttinen's advice to the context of an ontology build activity stream, suggests that during the build activity it is necessary to iteratively consider the ontology's domain (in this case the business model of a firm) as a system of systems from four perspectives:

1. *Function*: Why does the firm exist (purpose / goals / outcomes / results).
2. *Structure*: What is the organization of the firm (components, their inter-relationships, includes human resource "organization structure" and other structures within the firm).
3. *Process*: How things happens over time (activities, sequence, location, know-how to produce outcome and meet goals).

4. *Context*: What is the firms relationship to containing whole (economic, social and biophysical environment).

Summarizing this approach Gharajedghi states: “I contend that seeing the whole requires understanding structure, function, and process at the same time. They represent three aspects of the same thing and with the containing environment (context) form a complementary set” (Gharajedaghi, 2004, p.110).

5.2.4 Inputs to Building

The literature review above on the processes used to build artefacts either assumes or explicitly suggests that the inputs to the build process are deep knowledge of the appropriate key theoretical frames, the problem and solution domains, gathered using appropriate methods. Hence, the inputs to building, the identification of the overall and detailed design principles was covered during the review of the literature that led to the overall research design (Chapter 3) and the preparation detailed research design (Chapter 4).

Recalling the introduction to the comparator knowledge sources (K1-6) for evaluation to produce useful feedback on artefact utility, the key theoretical frame knowledge sources (K0), the inputs to the build activity stream and comparator knowledge sources must not be the same (3.5.4.6).

5.2.5 Methods and Techniques for Build

This sub-section presents the results of a search of the literature for advice on the best methods and techniques to use during the build activity stream.

5.2.5.1 Extending Existing Works

All the exemplar organizational ontology researchers and much of the ontology engineering literature reviewed suggests that the utility of new and improved ontologies can be improved through the extension of existing works.

This approach is suggested to be both practical, and enables the proven validity of the ontology antecedent to add confidence that the new ontology will have high utility (at least in those aspects which are unchanged, or only augmented).

However, this is considered to also present some challenges. For example Uschold and Gruninger note that to build on an existing ontology requires the researcher to adopt the definitions of the constructs and relationships within the antecedent. This is only possible if these are clearly and transparently defined. In turn, to make this reuse a possibility, these authors recommend that definitions contained within ontologies are thoroughly documented (Uschold & Gruninger, 1996, p.16).

5.2.5.2 Design Science and Soft Systems Evaluation Techniques Relevant to the Build

During the review of the literature undertaken to prepare the detailed design of the evaluation activity stream (Chapter 6), three points relevant to evaluation, but applicable to activities undertaken in the build activity stream are highlighted and hence are discussed here.

Compatibility with Key Theoretical Frames

Firstly the advice on preparation described in Chapter 4 (4.2.1.5) suggests that it is critical, during the build activities, in order to create an artefact of high utility, to continuously re-confirm that that the ontology design (its constructs, their definitions, and the interrelationships between constructs described in a model) are compatible with the key theoretical frames.

Rigorous Definition and Formal Representation

Secondly Hevner et. al. recommends that during the build activities "the artefact itself must be rigorously defined [and] formally represented" (Hevner et al., 2004, p.81, table 1 p.82).

Based on his review of the ontology engineering and design science literature Al-Debei identifies six criteria for evaluating design artefacts (Al-debei, 2010, pp.43-46).

The first criteria, clarity, matches Hevner et. al.'s recommendation, and hence must be undertaken during build activities.

Al-Debei, summarizing the literature on clarity, states that

> *An ontology needs to successfully and objectively communicate the intended meaning of defined terms. Defined terms are concepts describing the domain, which will most likely be nouns (i.e. objects [constructs]), or verbs (i.e. relationships [a model]). Creating a list of these terms is important, as well as documenting their definitions in natural language [will impact human understanding / communication].* (Al-debei, 2010, p.43)

Al-Debei goes on to provide a summary of items which lead, if they occur in the designed ontology, to a reduction of clarity:

- *Construct overload: two or more ontological constructs map to one modelling (i.e. grammatical) construct.*
- *Construct redundancy: two or more modelling constructs map to one ontological construct.*
- *Construct excess: an existing modelling construct does not map to any existing ontological construct.*
- *Construct deficit: an existing ontological construct does not map to any existing modelling construct.*

(Al-debei, 2010, p.44)

Testing Definitions of Constructs and Their Interrelationships

Thirdly, the review of the systems thinking literature related to evaluation also identified an evaluation activity that needs to be integrated with build activities.

Baskerville et. al.'s innovative and recent work which proposed a methodology that integrates Soft Systems Methodology (SSM) and Design Science (introduced in

3.5.2.2 Soft Design Science Methodology) (Baskerville, Pries-Heje, & Venable, 2009). These authors suggest how design science evaluation activities are highly similar to SSM comparison activities and serve the same purpose: determining whether the designed artefact (which in the case of SSM are root definitions and a model and in the case of an ontology and constructs and a model) are fit for purpose.

> *The search for the design solutions [SSM stage 3 root definitions and stage 4 modelling, design science build activities] and the evaluation of the design solution are activities that take place in the abstract world of design thinking. Artefact construction and its evaluation are activities that take place in the real world of the social systems into which the artifact becomes situated* (Baskerville et al., 2009)

This suggests that during build activities SSM techniques used to test completeness and adequacy of root definitions and models could be useful. One of the key techniques of SSM in this regard is the application of CATWOE framework (Bergvall-Kåreborn, Mirijamdotter, & Basden, 2004; Mobach, van der Werg, & Tromp, 2000; Smyth & Checkland, 1976; Wilson, 2001).

The CATWOE framework consists of technique and knowledge. The technique aids the researcher in confirming that root definitions and models include all relevant: Customers, Actors, Transformation Processes, Weltanschauung (World-Views), Owners and Environmental Constraints. (Bergvall-Kåreborn et al., 2004; Mobach et al., 2000; Wilson, 2001).

Hence, using the CATWOE framework in evaluation activities undertaken in parallel to the build activities to provide feedback on the validity of an ontology's constructs and model from multiple world-views can be valuable.

More generally, any feedback whether formal or informal, gathered by an evaluation activity conducted in parallel to the build activities could enhance artefact utility.

5.2.5.3 Computerized Tools

The literature makes limited mention of a variety of computerized tools that have been used to produce the representations of ontologies. However, the literature does suggest that the use of these tools may enhance the quality of these representations and the efficiency with which they may be produced.

These tools range from simple drawing tools, through specialized tools which enforce the rules of the chosen modelling and/or representational formalism.

5.2.6 Representation of Designed Artefacts (Output of Build)

This sub-section presents the results of a search the literature for advice on the best approaches to representing the outputs from the build activity stream, the created ontology.

As noted in the introduction to ontologies, there are many approaches to describing ontologies from highly formalized (i.e. using mathematical, diagrammatic and / or formal written language) to semi- or informal representations (i.e. using ‘natural’ human language) (3.5.1.3).

The SSBMO is a semi-formal information systems artefact. Hence it seems appropriate to restrict the search of the literature on ontology representation to only consider existing and widely used information systems modelling formalisms that have been successfully used to describe semi-formal ontologies.

Considering widely used existing formalisms has the advantages of:

- The academic and practical validation of these formalisms.
- The increased likelihood for the generic ontology benefit of enhanced communication to be realized (multiple others will be familiar with the modelling formalism).
- Providing internal consistency to the description of the SSBMO.

However, like any formalism (and indeed any model) there is the risk that a critical concept is excluded from the ontology because the rules of the formalism used to represent the ontology forbid it.

All three of the exemplar organizational ontology researchers note explicitly or implicitly the possibility that their ontologies may be operationalized in a digital information system: specifically as the structure of a relational database[3] for storing instances of their ontologies.

As a result, all three of these researchers used, to one degree or another, a diagrammatic relational database design formalism to express their ontologies. Other business model scholars have adopted the same formalism (Andersson et al., 2006).

Osterwalder, not only explicitly defined his ontology in terms of a relational database design formalism, but subsequently released commercial products containing a database whose structure was based on this design to store users' business models (i.e. instantiations of the ontology) (Osterwalder & Smith, 2012; Smith, Osterwalder, Business Model Foundry GmbH, & Hortis - Le Studio, 2011)[4].

A recent business information systems text book notes that "the Entity Relationship Diagram (ERD) [is a] commonly used model for designing the organization [(structure)] of a relational database" (Huber, Piercy, McKeown, & Norrie, 2007, p.221).

The formalism underlying an ERD is the mathematical graph based Entity Relationship Modelling formalism (ERM). This was first defined in 1976, at about the same time the mathematical underpinnings of the relational database were created (Chen, 1976). The key advantage of the ERM formalism over earlier approaches to describing concepts and their inter-relationships was stated to be:

> *The entity-relationship model adopts the more natural view that the real world consists of entities and relationships. It incorporates some of the important semantic information about the real world.* (Chen, 1976)

[3] A relational database is one whose internal structure enables the storing of data and an arbitrary number of relationships between data. It is the most common type of database technology in use today. Contrast this with earlier hierarchical database technologies that limited the number of relationships which could be simultaneously stored between data, and the more recent object oriented databases where objects containing data and their inter-relationships are stored together.

[4] Osterwalder never explicitly mentions his use of a diagrammatic relational database design formalism. However, it is clear from his diagrams and from his subsequent use of the ontology to instantiate relational databases that this is what he was doing; his lack of a specific citation, coupled by his inclusion of some object oriented diagrammatic notations, makes it unclear whether he was attempting to following a specific diagrammatic formalism or not.

There is considerable face-validity to this claim in the wide-spread use of entity relationship modelling in digital information systems requirements gathering. This includes the author's own experience, where he has been able to have meaningful discussions with the potential users of digital database information systems about the business content of a required database (i.e. 'real-world entities, their attributes and relationships') using the ERM formalism expressed as an ERD.

Given the usability requirements for the SSBMO (RQ, RO1, RO2), and the expectation that the vast majority of users will not be familiar with the technicalities of any modelling or diagrammatic formalism, this advantage and its face-validity makes the ERM formalism and the ERD visual representation highly attractive.

Further, ERM is known to be well aligned with the design science approach. March and Smith noted in their important article concerning design science in information systems research how entity relationship models contain the same elements that they define as the outputs from design science research: constructs and a model. Hence they argued that artefacts described using ERM formalisms where appropriate outputs from design science research (March & Smith, 1995, p.256).

It should be noted that ontological researchers taking a more formal approach (i.e. ontology engineers), or those wishing to record their semi-formal ontology in a rigorous formalism, such as two of the exemplar organizational ontology researchers, have used other modelling formalisms. For example the Unified Modelling Language (UML) is used by Al Debei (2010, p.59-60), and once expressed using a modified form of ERD, Osterwalder then further formalises his ontology into the "Business Model Modelling Langugage (BM^2L)" using eXtensible Markup Language (XML) (Osterwalder, 2004a, pp.118-126).

5.3 Choosing the Approach for Build

The review and summary of the literature on building artefacts from the design science, ontology engineering and soft systems methodology fields was presented in the previous section. This included the definition of building, along with the recommended process for rigorously undertaking building, the inputs to and the representations of the outputs from building, the methods and techniques that may be used, and the impact of rigour on artefact utility.

This section presents a reflection on this literature in light of the research objectives; the following section presents the results of applying this reflection to make choices to create the build activity stream detailed design.

5.3.1 The Current State of the Art

The literature suggests that understanding how best to rigorously create an artefact is a relatively new field of research. The advice and guidance on how to construct a high quality build research design that is rigorous, and hence maximizes the likelihood of research legitimacy, is at best incomplete.

For designers of build research designs the literature has a troubling lack of specificity in:

1. How to best use the overall and detailed design principles derived from the key theoretical frames to construct an artefact that will subsequently evaluated as having high utility.
2. How to abduct the best design, including which methods and techniques to use.
3. How to best integrate build and evaluation activities to maximize artefact utility.

However, despite these concerns, recently the exemplar researchers have all managed to construct and justify their build research designs. The strong impression one receives is that these researchers have abducted their build research designs from the literature based on their understanding of the connection between build rigour, the resultant utility of their artefacts and hence the legitimacy of their research.

5.3.2 Build Research Design Goals

5.3.2.1 Introduction

Though the exemplar researchers successfully defended their research designs, there is room for improvement. A possible contribution of this research is to improve research output quality by attempting to be more explicit in the process that creates the build stage of the research, i.e. defining the design goals, the possible choices of research design, the selected choice and the basis for these choices[5].

Hence, the goal in this sub-section is, based on the literature, to be as explicit as possible about the process by which the build activity stream is designed.

5.3.2.2 Build Research Question

The research question for the build activity stream follows on from the research question for the preparation activity group P4 literature review (introduced in 3.5.3.4):

> **RQa**: How can strong sustainability emerge as an outcome of an organization understood as a multi-minded ideal-seeking purposeful system (analysis), and what systems contain / provide context for an organization so understood (synthesis)?

The response to this question was developed in Chapter 4: the detailed design principles (DDP1..6, CDP1-3). The research question that now guides the build process to create the SSBMO (also introduced in 3.5.3.4) is:

> **RQb**: How can the detailed design principles be modelled using an ontology in order to enable a tool useful for managers attempting to design the conditions from which strongly sustainable outcomes may emerge from and for their organizations?

The process to answer RQb is described in the remainder of this chapter. This research's answer to RQb is recorded in Chapter 7.

[5] i.e. the search, reflect, apply steps set out at the start of this part.

5.3.2.3 Detailed Goals

The literature on the design of the build stage makes it clear that typical risks to research output validity that apply when designing any kind of systemic design science (and indeed qualitative research in general) also apply to the build stage of design science research.

Applying the earlier analysis of these general points (3.5.4): it is important to identify research design goals that aim to mitigate these risks. Specifically it is a goal of this build research design that there be:

- Use of iteration in the construction of the SSBMO (3.5.4.3)
- Explicit setting of boundaries for the SSBMO (3.5.4.4)
- Explicit consideration of the world-views of the users and designer of the SSBMO (3.5.4.5) and key theoretical frames based on those world views (K0, K0-PF, K0-SS).

5.3.2.4 Constraints on the Choices of Build Research Design

There are always practical constraints when making the choices between possible build research designs. As part of being explicit about the research design process for this research, these constraints are:

1. Time to research techniques and method.
2. Time to search literature, create the research designs.
3. Time to apply detailed design principles to create the SSBMO.
4. Effort available within available time.

Clearly any constraints will have an impact on the rigorousness and quality of the research designs, the SSBMO and the SSBMC it powers. However, within the scope of an exploratory thesis, which is not claiming a high degree of generalizability, and in comparison with examples from the exemplar literature, these compromises are not problematic. They simply open avenues for further research (described in Chapter 11).

5.4 Build Detailed Research Design – Overview

This section applies the reflection of the literature searched above. It introduces the detailed research design created to build the SSBMO and the SSBMC it powers developed from the overall and detailed design principles (Chapter 3 and 4) given the overall research objective (Chapter 2 and 3.6.6) and the build research design goals (5.3.2).

Each of the four build activity groups within the build activity stream that are introduced in this section are described in the following four sections (5.5-5.8).

A summary of the build activity stream is provided at the end of this Part (Table II-2).

5.4.1 Overall Approach

Firstly, as described in Chapter 4, Preparation Activity Group P4 identified design principles from the literature. These are then used to inform and ensure the choices made during the Build Activity Stream adhere to the design principles. In turn this increases transparency over earlier research (i.e. the exemplar ontology research), and hence legitimacy of this research.

Secondly, as noted in 4.3.3, the state of knowledge in the problem and solution domains is not consistent. The level of detailed knowledge about profitable business models and modelling (K0-PF) far exceeds the level of detail of the knowledge on this topic from the strongly sustainable world-view (K0-SS). Indeed it was this observation that initiated this research (Chapter 2).

For example, during preparation, Osterwalder's BMO (and the BMC it powers) was identified as an apparently unique detailed work in the K0-PF key theoretical frame (4.5.5.5). It appears to provide the best and most comprehensively used and validated overall ontology for the description and design of profitable businesses available. The high utility of the BMO is confirmed by its validation and the use of the BMC it powers.

In contrast, only very limited numbers of relevant ecological- micro- sociology or economics business model works were found, and these did not appear to be rigorously derived, validated or in wide-spread use (4.6.5).

Since in order to comply with ODP2, the SSBMC must be able to be able to describe business models conceived from world-views anywhere on a continuum from profit-first (K0-PF) to strongly sustainable (K0-SS), it appears the Osterwalder's BMO is a legitimate and pragmatic starting point for the creation of the SSBMO artefact.

Further, given the amount of validation of the BMO (and use of the BMC), a first overall Build Principle is established:

BP1: The SSBMO will be created by making the smallest number of changes, and the minimum increase in elaboration, to the Profit-First BMO so as to allow the description or design of businesses whose goal is any where on the continuum from:

– Maximizing monetary profit (as per K0 and K0-PF key theoretical frames)

– Maximizing Strongly Sustainable outcomes (as per K0 and K0-SS key theoretical frames).

This first Build Principle is intended reduce the likelihood of invalidating the proven utility of the BMO to describe profit first business models while ensuring only the changes required to fully represent strongly sustainable business models (as justified by the key theoretical frames) are included in the SSBMO.

Operationalizing this build principle leads to the following three questions, answered by the building of the SSBMO artefact:

Given constructs and model that constitute the BMO:

1. What's missing from…

2. What needs to be changed in…

3. What, if anything, needs to be deleted from…

… the BMO to create a SSBMO that adheres to the overall and detailed design principles (ODP1 & 2, DDP1-6)?

In other words the SSBMO will be created by making the smallest number of changes to the BMO so that the resultant artefact adheres to the SSBMO overall and detailed design principles. Changes will only be made where they can be justified by the latest natural, social, and economical science (as encapsulated in the overall and detailed design principles).

By continuously asking these three questions in the context of the design principles derived from the key theoretical frames the build activity stream will continuously evaluate the SSBMO against "authoritative data sources" (as per 5.2.5.2).

Thirdly, applying the advice in the literature on undertaking formal and informal evaluation activities in parallel with the build activities in order to maximize artefact utility (5.2.5.2), a second overall Build Principle is established:

BP2: During the build activities the SSBMO will be subject to evaluation of increasing formality and using increasing numbers of sources and types of comparator knowledge.

In other words, the build and evaluation activity streams will run to some degree in parallel, with the iteration within the build activity stream (5.2.3.5) enabling feedback from the evaluation activity stream to be incorporated into the SSBMO during its construction.

5.4.2 Activity Groups within Build

Within the build research design goals (5.3.2.3), constraints (5.3.2.4) and Build Principles (5.4.1), it was determined that four iterations of the build process are required. Each iteration is considered to be a single build activity group, as shown in Figure 5-1. The second Build Principle also informed the timing and relationship between the build activity groups and the evaluation activity groups (introduced here and fully described in Chapter 6).

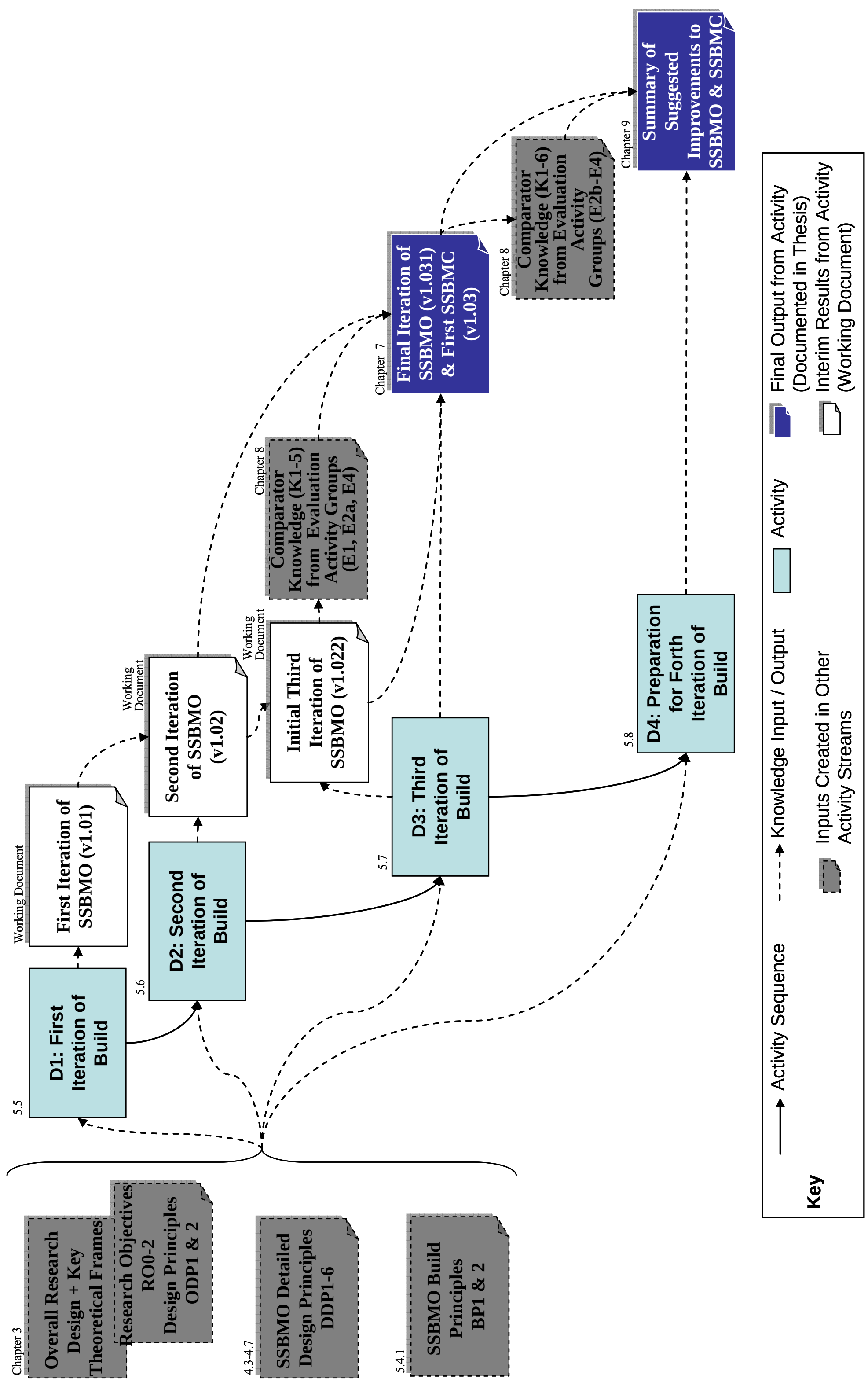


Figure 5-1: Build Activity Groups and Relationships of their Inputs and Outputs

As shown in Figure 5-1 each build activity group takes as input the overall research design, key theoretical frames (K0, K0-PF, K0-SS), research objectives (R0-2),overall design principles (ODP1 & 2, Chapter 3), the detailed design principles (DDP1-6, CDP1-3, Chapter 4) and the build principles (BP1 & 2) (5.4.1).

Each activity group uses these inputs, along with output from the prior iteration, as follows:

D1.**First Iteration of Build of SSBMO**. Produces the first iteration of the SSBMO, described in working documents (v1.01).

D2.**Second Iteration of Build of SSBMO**. Produces the second iteration of the SSBMO, described in working documents (v1.02).

D3.**Third Iteration of Build of SSBMO and the Build of the SSBMC**. Produces an initial third iteration of the SSBMO and first iteration of the SSBMC, described in working documents (v1.022).

These are evaluated by the evaluation activity stream (activity groups E1, E2a and E4) to gather feedback to be used to finalize the third iteration. The evaluation process is described in Chapter 6, the results in Chapter 8.

The resultant third iteration of the SSBMO and SSBMC are described in Chapter 7 (v1.031). This final third iteration is evaluated by the evaluation activity stream (activity groups E2b and E3) to gather feedback on artefact utility. These evaluation activities are described in Chapter 6, the results in Chapter 8.

D4.**Preparation for Forth Iteration of Build**. Undertaking a fourth build iteration based on the output from the evaluation activity stream was deemed out of the scope of this work. However, preparation for this fourth iteration is undertaken. It results in a summary of suggested improvements to the SSBMO and SSBMC that may increase their utility (recorded in Chapter 9).

Build activity groups D1-3 each undertake one iteration of the function, structure, process, structure approach described in 5.2.3.5.

Note that the sequence of execution of tasks within the build activity groups is largely linear. However, as per 5.2.3.5, iteration and recursion were used, and this includes tasks in different activity groups and indeed in other activity streams.

5.4.3 Definition Description (Capture)

The ontology engineering advice on establishing an approach to capturing the definitions of the constructs and their interrelationships (5.2.3.1) is followed through the use of the Management Information Systems Modelling formalism of Entity Relationship Modelling (ERM) (5.2.6).

This follows Osterwalder's lead: he used a form of ERM to capture the BMO.

Table 5-1 shows how the chosen design science research outputs (Table 3-13) map to the elements of the ERM formalism used to capture the description of the SSBMO.

Design Science Output Element	Entity Relationship Modelling Formalism Element
i. Constructs	Entities (singular noun)
ii. Models	All Inter-relationships between the Entities (including a verb)
iii. Instantiations	Instances of all the Entities and their Inter-relationships
iv. Method	Not Applicable

Table 5-1: Relationship of Design Science Output and Entity Relationship Formalism Elements

As per Detailed Design Principle 1 (DDP1, 4.4.6) the ERM formalism is used to capture the design of the SSBMO, that adheres / complies with the ontology Overall and Detailed Design Principles (ODP 1 & 2 and DDP1-6). The use of the ERM formalism requires:

- Unambiguous definitions of and summary labels for each required construct (the entities) to adhere to the design principles

- Identification and unambiguous definitions of the inter-relationships between the identified constructs (the model) required to adhere to the design principles. This includes the cardinality of the inter-relationships and unambiguous labels.
- Identification and unambiguous definitions of the attributes of each entity required to adhere to the design principles. This includes summary labels for each attribute.
- Descriptions of each entity, relationship and attribute, including reference to the applicable design principles. Referring to the design principles automatically references supportive citations contained in the exploration of the key theoretical frames (Chapters 3 and 4).

Each entity within the model may be considered as representing a question that a business model designer must answer (possibly with multiple distinct complementary responses; i.e. each entity will have multiple instances). Answering the question posed by the appearance of an entity within the SSBMO does not, of course, mean the answer will necessarily lead to a business model that will enable strongly sustainable outcomes to emerge. The literature reviewed, as summarized in the design principles, only suggests that answering these questions is necessary for the possibility of strongly sustainable outcomes to emerge. Sufficiency may be attempted by answering the questions posed by the entities using the knowledge from the formal, natural and social science reviewed in Chapters 3 and 4 (the uncertainty in this statement reflects the humble approach taken to the completeness of and our ability to accurately apply the knowledge of key theoretical frames)[6].

These definitional descriptions are presented in a standardized manner (7.2.2) and comprise the majority of Chapter 7.

[6] The entities included in the SSBMO are determined by ensuring adherence to the Ontology Design Principles (ODP1 & 2, DDP1-6) derived from the key theoretical frames. At this time work to derive Strongly Sustainable Business Design Principles from the same key theoretical frame has started. The business design principles would provide a range of acceptable answers to the questions posed by the entities in the SSBMO. Definition of aligned metrics and threshold values for a strongly sustainable organization is also underway, also derived from the same key theoretical frames. The author is participating in this work being undertaken by a number of organizations globally (Upward, 2012b).

5.4.4 *Detailed Diagrammatic Formalism (Coding)*

The ontology engineering advice on establishing an approach to capturing the definitions of the constructs and their interrelationships (5.2.3.1) is followed through the use of an Entity Relationship Modelling (ERM) diagrammatic formalism, the Entity Relationship Diagram (ERD) (5.2.6).

As per Detailed Design Principle 1 (DDP1, 4.4.6) the ERD diagrammatic formalism is used to capture the design of the SSBMO, from the remaining detailed design principles (DDP2-6). This follows Osterwalder's lead: he used a modified form of ERD to code the BMO.

There are a number of variations of the ERD diagrammatic formalism[7]. In this work the ERD diagrammatic formalism originally described by Richard Barker in 1981 (Subsequently published in Barker, 1989)[8] is used. This is sometimes known as the "crow's foot" notational form of ERD, after the three lined symbol used to illustrate a 'many' relationship between entities.

In this thesis the most detailed diagrammatic representations of the SSBMO use the Barker ERD formalism as enforced by the computerized drawing tool yEd[9]. For comparison the BMO at the same level of detail is also presented. These detailed representations are included in the accompanying electronic files listed under the "List of Supplementary Materials" in the Front Matter of this thesis (SM2, SM4).

The selected detailed diagrammatic formalism is described below and illustrated by an example in Figure 5-2:

[7](Wikipedia Authors, 2012a) provides a good summary of the range of ERD formalisms in existence and common use .
[8] A summary is provided by and a more detailed tutorial and description by (Cartmell, 2012). For further information consult (Full descriptions may be found in Eva, 1994; Longworth & Nicholls, 1986)
[9](yWorks GmbH, 2012)

- An entity is coded as a rectangular box with a solid border with a label (a singular noun) that summarizes its full definition (capture). An instance of an entity would be an example of the definitional noun[10].
  - Entity boxes may vary in size and may be filled with or shaded with colour to aid understanding by consistently colouring entities with similarities.
  - Box size has no meaning in the entity relationship diagrammatic formalism and is chosen for overall visual simplicity (minimizing number of bends and crossing in relationship lines for example)
  - Box colour has no formal meaning, although it may be used to help a reader understanding relationships between groups of entities
  - Box spatial position relative to other boxes conveys relationships between an entity and a generalization entity.
- An entity may be a generalization (some conceptual part of, connection to, or context for) of one or more other entities. Generalized entities are coded as a rectangular box with rounded corners, surrounded by a dotted line that contains one or more other entities[11].

[10] Strictly speaking the Entity Relationship Modelling formalism describes sets of relevant entities and sets of relationships, not single entities nor single instances of relationships. However, following long standing convention when building entity relationship models, in the SSBMO entity relationship diagram that codes the SSBMO artefact, the distinction between entities and their individual relationships and sets of entities and instances of their relationships will be ignored.

However, when reasoning using the SSBMO about patterns of strongly sustainable business models or a specific firm's business model, the distinction is important. In patterns of strongly sustainable business models described using the SSSBMO single entities ('instances of an entity') and a single instance of a relationship between instances of two entities will be described (the instances of the two entities and the instance of relationships being 'generic' in some fashion as befits a pattern). Similarly, in instantiations of the SSBMO used to describe a specific firm's business model (the instances of the entities and instances of their relationships describe a firms 'actual' or 'planned' business model).

[11] This is a convention adopted by the computerized drawing tool.

- Entities that are not generalizations are known as specific entities. A specific entity:
  - May not be a specifization[12], in which case the entity is not contained in any generalized entity box.
  - May always be a specifization of one or more generalizations, in which case the entity is wholly contained within one or more generalization entity boxes.
  - May sometimes or partially be a specifization of one or more generalizations, in which case the entity partially overlaps with one or more generalization entity boxes[13]
- Relationships between entities are coded by lines connecting two entities with one or more labels (that include a verb) that summarizes the nature of the relationship.
  - A relationship of a instance of an entity to another instance of the same entity, is known as a recursive relationship. This is shown by a line starting and ending on the same entity, usually from one edge to the closet orthogonal edge; the shape made by this line causes these relationships to be known as 'pig's ears'.
- For neatness and to aid comprehension relationship lines:
  - Are straight when ever possible. Where routing the line is required the fewest number of corners is attempted and an attempt is made to have at least one line segment parallel and / or orthogonal to the edges of the connected entity boxes.
  - Avoid crossing other lines when ever possible. Where a crossing is required one of the lines crossing has a gap in it.

[12] i.e. has no related generalization.
[13] This may be a non-standard notational form; Upon consulting an ERM expert (Cartmell, 2012), it was felt to be unimportant.

- The possible cardinality of the relationship is coded at each end of the related relationship line using:
  - A numeric tuple (i.e. x, y), where x is the minimum and y is the maximum number of instances of the entity that the tuple is shown closest to. x and y may take values 0, 1 or n, where n is any integer greater than 1. n is read as 'many'.
  - In the case of a many relationship, two short forty five degree sloped lines are added either side of the relationship line as it meets the entity box (forming the 'crows foot').
  - In the case of sub-class relationship (i.e. one entity "is an" other entity), an arrow is used[14].
  - In the case of mutually exclusive alternative relationships, the tuples of the mutually exclusive relationships are shown as white text on a dark background[15]. In the case of an entity having more than one group of mutually exclusive relationships, the tuples in each group are shown with the same background colour.
- The relationship is understood from the diagram by combining the pluralized nouns from each entity (since strictly speaking the relationship between the entities is between instances of the entities not the entities themselves), the verb from the relationship label and the cardinality to form a sentence.
  - The sentence may be constructed by started from either entity.
  - The cardinality for the relationship is shown furthest from the entity to which applies.

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[14] This is a non-standard notational form adopted by Osterwalder, and carried over only to enable an accurate representation of the BMO; it is not used in the description of the SSBMO.

[15] The normal diagrammatic formalism is to show an "exclusion arc" crossing the group of relationship lines which are mutually exclusive. The selected drawing tool does not currently support this part of the diagrammatic formalism so this non-standard alternative was adopted (a feature request was made but its implementation was not completed at time of writing).

- If the description of the relationship is not the same in both directions, the label describing the nature of the relationship is shown closest to entity to which it applies

- Any identified attributes of an entity are coded by listing their labels (a singular noun) in an oval connected to the entity by a solid line. Potential values of attributes, or rules for determining valid values, which may occur in a specific instance of the entity, are described using the Backus-Naur Form grammar[16].

- Keys are one or more attributes whose values collectively must be unique to identify an instance of an entity.

  - The labels of the attributes that form the key to an entity, if identified, are underlined.

  - If the keys of one entity are identified and also form part of the key of a second entity (so called "foreign keys"), this is indicated by a short line at right-angles to the relationship line closest to the second entity. Such keys may optionally be shown as attributes of the second entity.

- Any comments about entities or attributes may be coded in rectangular boxes with dotted lines joined by a line to the entity or relationship to which the comment applies.

- The SSBMO is a 'logical' entity relationship model, hence

  - Relationships between entities with many-to-many cardinalities are shown without resolution in an intermediate entity (Such resolution is required for physical database implementation and must be shown in a 'physical' data model).

[16] BNF is one of the most commonly used grammars for expressing the syntax of formal languages in computer science (Backus, 1959; Knuth, 1964). See Part V Annotated Glossary for a description of this grammar as used herein.

– Keys may not be identified if doing so is not logically required (keys must always be defined for physical database implementation and must be shown in a 'physical' data model).

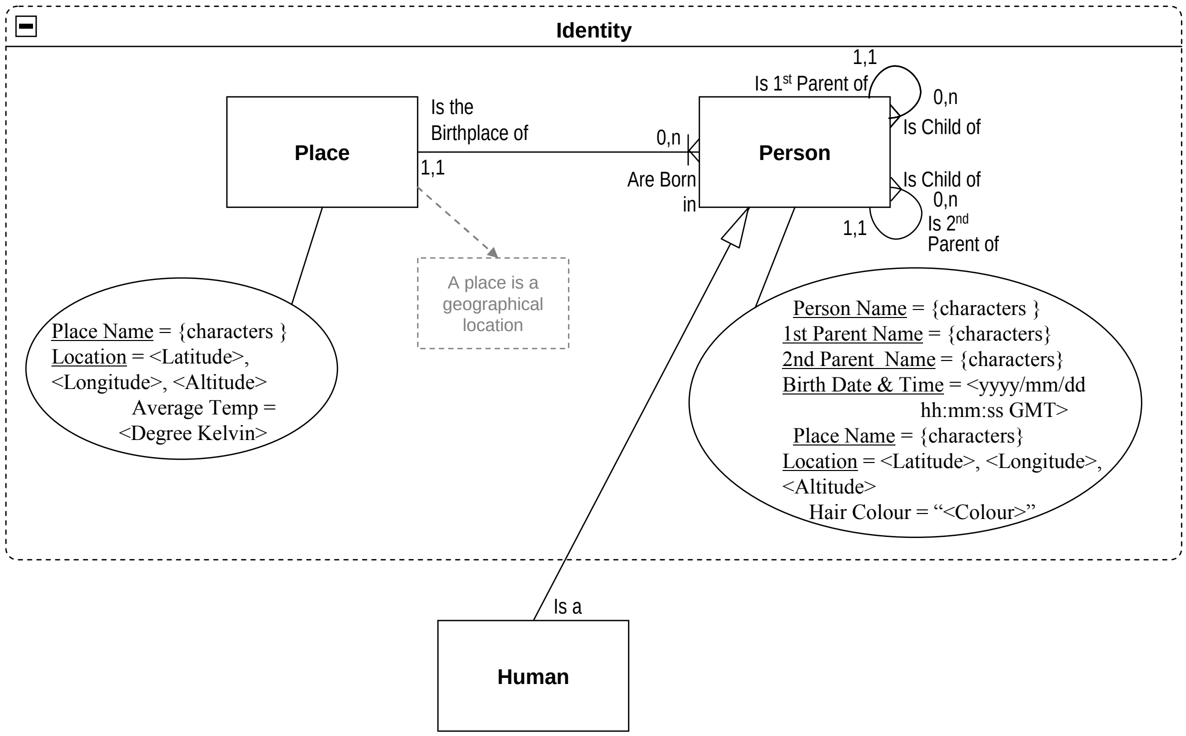

Figure 5-2: Example of Four Entities Coded Using the Crows Foot ERD Diagrammatic Formalism

Figure 5-2, uses the entity relationship diagrammatic formalism to describes some subset of human identity. It may be understood as follows:

- Identity is a possible generalization of place and person; place and person have some conceptual relationship with the concept of identity (this would be described in the accompanying definitional textual description).
- A human is a person and a person is human
- Places have names that consist of any combination of any number of alphabetic characters

- Places have a location described by a triple of latitude, longitude, and altitude
- Places have an average temperature measured in degrees Kelvin
- Places are uniquely identified by a key: the combination of their name and location (but not their average temperature)
- Persons have names that consist of any combination of any number of alphabetic characters
- Persons have two parents, who have names that consist that of any combination of any number of alphabetic characters[17]
- Persons have a date and time of birth
- Persons have a single place of birth which must be described in the place entity
- Persons have a hair colour
- Persons are uniquely identified by a key: the combination of their name, the names of their parents, the date, time and place of their birth (uniquely by the "foreign key" of an instance of the place entity). Their hair colour is not part of the unique identifier of a person
- Places may be the birthplace of none, one or more persons
- Persons are born in exactly one place
- Each person is the child of exactly two parents
- Each person may be the first or second parent of none, one or more persons

[17] Cases of adoption, surrogacy, etc. are excluded from this model. Further it is assumed that the parents name alone is unique; a more reliable approach would be to include, as a foreign key, the key of person for each parent. This was not done for this example, as it would over complicate the example.

5.4.5 Summary Diagrammatic Representations

As per Detailed Design Principle 1 (DDP1, 4.4.6), and again following Osterwalder's lead, a summary visualization of the SSBMO (and for comparison of the BMO) is also provided.

These summary representations are also included in the accompanying electronic files listed under the "List of Supplementary Materials" in the Front Matter of this thesis (SM1 for the BMO, SM3 for the SSBMO).

These summary visual representations are compliant with but simplify the ERD notation as follows:

- Any entity that has a significant number of relationships with a significant number of other entities is shown as per a generalization, i.e. it is shown as containing all the entities with which it has one or more relationships.
  - Such entities are shown as normal entities (i.e. rectangular box with solid border with a label)
  - This avoids "cluttering" the summary diagram with too many relationship lines
- Attributes are not shown
- Relationship lines but not labels nor cardinalities are shown
- Recursive ('pig's ear') relationships are not shown

5.4.6 Visual Design Tool Representations

As per Detailed Design Principle 1 (DDP1, 4.4.6) the SSBMO is considered to conceptually power the SSBMC visual design tool by expressing the SSBMO in visually attractive form, derived from the SSBMO diagrammatic formalism. As per the Canvas Design Principles (CDP1-3 4.7.3), this is intended to help managers of firms more easily comprehend, engage with and use the SSBMO.

Hence the SSBMC diagram does not follow the rules of the SSBMO diagrammatic formalism. The SSBMC diagram remains compatible with the SSBMO by:

- Combining some entities into a number of blocks shown as labelled areas bounded by lines.
- Locating these areas adjacent to one another so as to indicate by proximity the most important relationships between the underlying entities.
- Providing short textual descriptions of each of the blocks ('help') derived from the description of the entities combined for each box (7.3 and 7.4).

Several variants of the SSBMC visual design tool representation of the SSBMO are also included in the accompanying electronic files listed under the "List of Supplementary Materials" in the Front Matter of this thesis (SM5a-c).

5.4.7 Instantiation of SSBMO

The evaluation and use of the SSBMO requires its instantiation to describe the current or desired business model of a specific firm. The following describes how the entities, attributes, relationships and keys in the SSBMO ERD diagrammatic formalism are instantiated to describe the business model of a specific firm.

Most of the instantiations of the SSBMO prepared during evaluation activities contain information proprietary to each firm whose business model is described. However, one example is provided in the accompanying electronic files listed under the "List of Supplementary Materials" in the Front Matter of this thesis (SM6). Since the preparation of this instantiation was part of evaluation activity group E1, this process is described in Chapter 8.

Two modes of instantiation are possible, using a series of related spreadsheets, and using a relational database management system. When instantiating the SSBMO:

- Using a spreadsheet tool[18]:
  - Each entity becomes a spreadsheet tab of a workbook
  - Each attribute becomes a column of the spreadsheet
  - Each instance of an entity, i.e. an example of the construct described by the entity, becomes a row in the spreadsheet as defined by the values of the attributes which uniquely identify and describe the instance. The values of the instance's attributes are recorded in the cells of the row.
  - Relationships between instances of entities are captured by the recording of values of the foreign keys of the related entity instances in the appropriate cells.
- Using a relational database management system:
  - Each entity becomes one (or more tables)[19]
  - Each attribute becomes a field of the table.
  - Each instance of an entity, i.e. an example of the construct described by the entity, becomes a row in the table as defined by the values of the attributes which uniquely identify and describe the instance. The values of the instance's attributes are recorded in the fields of that row.
  - Relationships between instances of entities are captured by the recording of values of the foreign keys of the related entity instances in the appropriate fields.

[18] The terminology is from the computerized spreadsheet tool Microsoft Excel 2003.
[19] Relationship database management systems need an ERM to be converted from a 'logical' form to a 'physical' form in order to be instantiated. For example any relationship which is 'many to many' (a crows foot at each end) needs to be physically resolved by a intermediate entity containing, as foreign keys, the keys of both the related entities.

5.4.8 Instantiation of SSBMC

The evaluation of the SSBMO requires its instantiation in a form comprehensible by managers of firms who wish to describe the current or desired business model of a specific firm. This is the primary purpose and use of the SSBMC (as per ODP2, 3.5.1.5 Achieving the Generic Benefits of Ontologies). This is described in Chapter 6.

Most of the instantiations of the SSBMC prepared during evaluation activities contain information proprietary to each firm whose business model is described. However, one example is provided in the accompanying electronic files listed under the "List of Supplementary Materials" in the Front Matter of this thesis (SM7).

The following describes how the building blocks of the SSBMC are used to create an instantiation of the SSBMO that describes the business model of a specific firm:

- Each instance of the entities summarized by a SSBMC block is recorded on a sticky note, and applied to an appropriate area of the SSBMC.
- The sticky note will record a subset of the attributes of the instance of the summarized entities, usually a uniquely identifying label for the instance.
- Relationships between sticky notes in different blocks may optionally be indicated. This can be achieved by using a common colour of post-it notes, or lines between the related post-it notes.
- Sticky notes may by physical, if a wall sized SSBMC is being used, or virtual, within a computerized drawing tool which is editing the electronic version of the SSBMC.

5.4.9 Summary

The above has introduced the four build activity groups within the build activity stream. The next four sections describe each of the build activity groups in detail.

5.5 Build Activity Group 1 – First Build Iteration (D1)

5.5.1 Introduction

The first build activity group takes as input the overall research design, key theoretical frames (K0, K0-PF, K0-SS), research objectives (R0-2),overall design principles (ODP1 & 2, Chapter 3) and the detailed design principles (DDP1-6, Chapter 4) and produces the first iteration of the SSBMO, described in working documents (v1.01).

5.5.2 Tasks as Undertaken

Following the completion of preparation activity group P4 (the identification of the Detailed Design Principles, DDP1-6), and following Build Principles 1 and 2 (BP1 & 2) the following tasks were completed:

- A summary diagrammatic representation of the Business Model Ontology (Osterwalder, 2004b; Osterwalder, 2004a, p. 44) and the detailed, formal diagrammatic representation of the Business Model Ontology (Assembled from Osterwalder, 2004a, pp.42-102) were prepared using the selected computerised drawing tool to enforce the selected diagrammatic formalism[20, 21].
- These were then examined for functional, structural, process and contextual gaps (5.2.3.5) based on DDP2-6 asking the questions suggested by BP1.
- All identified gaps were documented.
- Potential resolutions to the gaps were considered and documented.
- Textual and graphical notes and questions on each of function, structure, process and context were prepared as input to D2.

This work was completed July 5-12, 2011.

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[20] These representations are included in the accompanying electronic files listed under the "List of Supplementary Materials" in the Front Matter of this thesis.

[21] Although the summary diagrammatic representation of the BMO was present in the PhD dissertation and defense presentation, the detailed view was not included as a whole. Rather each part of the BMO is described separately with summary diagrams and full details only included in accompanying text. The detailed formal diagrammatic representation of the Business Model Ontology included with this thesis was derived from these summary diagrams and descriptions.

5.6 Build Activity Group 2 – Second Build Iteration (D2)

5.6.1 Introduction

The second build activity group takes as input the output from activity group D1, the overall research design, key theoretical frames (K0, K0-PF, K0-SS), research objectives (R0-2),overall design principles (ODP1 & 2, Chapter 3) and the detailed design principles (DDP1-6, Chapter 4) and produces the second iteration of the SSBMO, described in working documents (v1.02).

5.6.2 Tasks as Undertaken

Following the completion of D1, continuing to follow BP1 the following tasks were completed:

- Summary diagrammatic representation of the SSBMO was produced using the selected computerised drawing tool.
- A textual description to accompany the summary was written, capturing:
  - All the information required to produce a detailed formal diagrammatic representation of the SSBMO (v1.02).
  - A side by side working paper comparison of the definitions of all the BMO and SSBMO entities, attributes and relationships was prepared to act as a transparent audit trail or change log (Working Paper #1 ~80 pages, available upon request).
  - All the additions and changes made to the BMO to close the gaps identified in D1, to arrive at the SSBMO (as per BP1). Citations to the sources in the literature used to resolve each gaps were identified.

This work was completed July 13-16, 2011.

5.7 Build Activity Group 3 – Third Build Iteration (D3)

5.7.1 Introduction

The third build activity group takes as input the output from activity group D2, the overall research design, key theoretical frames (K0, K0-PF, K0-SS), research objectives (R0-2),overall design principles (ODP1 & 2, Chapter 3) and the detailed design principles (DDP1-6, Chapter 4) and produces an initial third iteration of the SSBMO (v1.022).

Aspects of the utility of this version of the SSBMO are then evaluated by activity groups E1 and E2a, described in Chapter 6. The results of the evaluation are documented in Chapter 8.

The results of the evaluation activity groups are used to finalize the third iteration of the SSBMO (v1.031) and develop the first iteration of the SSBMC (v1.03) (applying CDP1-4). These versions of the artefacts are described in Chapter 7.

This final third iteration of the SSBMO is evaluated by the activity groups E2b and E3 to gather comprehensive, independent and more formal feedback on artefact utility. Some of these evaluation activities use the SSBMC to help gather feedback on the utility of the SSBMO. These evaluation activities are described in Chapter 6, and the results are presented in Chapter 8.

5.7.2 Tasks as Undertaken - Initial

Following the completion of D2, continuing to follow Build Principles 1 and 2 (BP1 & 2) the following tasks were completed:

- Preparation of further detail of some of the changed and added entities.
- Revision of the summary diagrammatic representation of the SSBMO was produced using the selected computerised drawing tool (v1.022).

This work was completed between July 16, 2011 and January 31, 2012.

5.7.3 Tasks as Undertaken - Final

Following the completion of E1 and E2a, and considering the feedback on utility of the SSBMO gathered, while continuing to follow Build Principles 1 and 2 (BP1 & 2), the following tasks were completed:

- Revision of the summary diagrammatic representation of the SSBMO was produced using the selected computerised drawing tool (v1.031.
- Preparation of the detailed formal diagrammatic representation of the SSBMO using the selected computerised drawing tool to enforce the diagrammatic formalism (v1.031).
- Preparation of the diagrammatic representation of the SSBMC (v1.03)
- Description of each of the entities attributes and relationships in the SSBMO was prepared (Chapter 7).
- A summary of the changes between the BMO and SSBMO was prepared (Working Paper #2).

In order to create the SSBMC, in addition to applying CDP1-4, a review is undertaken of the format and presentation of the partial examples of business model instantiations in:

- Osterwalder's PhD (Osterwalder, 2004a): EasyMoney.com offering (Table 22) and value proposition (Figure 25), Barnes & Noble channel strategy (Figure 25), Orange mobile customer interface (Figure 38), Nokia channel strategy (Figure 36), Fotowire infrastructure management (Figure 47), overview of complete business model of The Montreux Jazz Festival (Figure 52), details of the Montreaux Jazz Festival value propositions (Figure 53), channel strategy (Figure 55), and value configuration (Figure 56).
- Popular works based on Osterwalder's subsequent practitioner work (Osterwalder & Pigneur, 2009; Osterwalder, 2010, 2011; Osterwalder & Pigneur, 2011; Osterwalder, 2011; Smith et al., 2011).

In addition, a discussion was held with marketing and communication expert, employed by a certified B Corp, on best approaches to convey descriptions of business models.

This work was completed between February 1, 2012 and February 28, 2013.

5.8 Build Activity Group 4 – Preparation for Forth Iteration of Build (D4)

Undertaking a fourth build iteration based on the feedback on artefact utility from all the evaluation activity stream was deemed out of scope for reasons of time and effort.

However, work to prepare for this fourth iteration was undertaken, and is documented in Chapter 9. This involves taking the output from evaluation activity group E4, the synthesis and analysis of the feedback on artefact utility gathered in evaluation activity groups E1-E3, and determining how this feedback might be best applied to further improve the utility of the SSBMO.

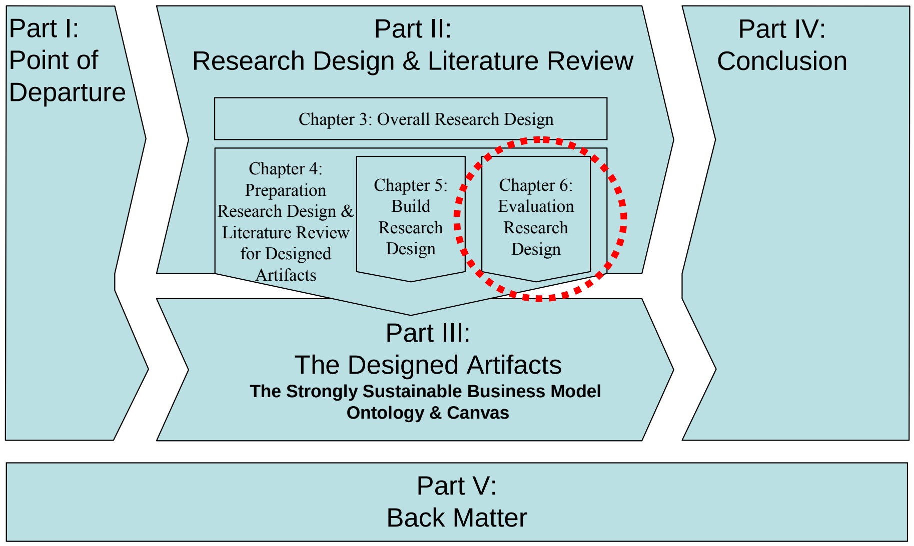
This work was completed between September 1, 2012 and March 31, 2013.

5.9 Summary of Build Detailed Research Design

A summary of the build activity stream detailed design is provided in Table II-2, at the end of Part II (after Chapter 6).

Chapter Six: Evaluation Research Design

Tryin' to make it real — compared to what? – Less McCann



Within the context created by the overall research design set out in Chapter 3 and the understanding developed of the key theoretical frames in Chapter 4, this chapter determines detailed research design for the evaluation activity stream. This is required to identify and plan the execution of the specific methods and techniques to be used to ensure rigour in the execution of the evaluation activity stream.

This chapter once again applies the three steps set-out at the start of part II. The search (A) of the literature that describes research designs for (approaches to) evaluating designed artefacts in the three research fields upon which this research draws and integrates: ontology engineering, design science and systems research is presented. From this search a reflection (B) that applies (C) the choices made to design the details of the evaluation activity stream of this research is presented.

6.1 Introduction

This chapter describes the creation of the evaluation detailed research design. In doing so this chapter describes a set of choices that contribute to the meeting of the research objectives (see 3.6.6) by responding to the question:

> How to best undertake the evaluation activity stream with the greatest rigour possible?

To answer these questions the three steps set-out at the start of this part (A-Search, B-Reflect, C-Apply) are used repeatedly.

These steps are used to operationalize the portions of the systemic design science methodology relevant to the evaluation activity stream identified in Chapter 3 (3.5.4).

6.1.1 Summary

In summary the review of the relevant literature presented in this chapter strongly suggests that the ability of a researcher to undertake the evaluation stage of a design science research project rigorously and achieve a high quality of results is highly dependent on the level of preparation of the researcher. i.e. does the researcher consciously understand and can they justify, based on legitimate precedent:

- Their world-view / biases
- The objectives of the research
- The objectives of the evaluation stage
- The process to be used to undertake the evaluation of the designed artefact
- The rationale for this process
- How the results of the evaluation will be used to meet the objectives of the research.

6.1.2 Chapter Structure

Recalling the three steps (A-Search, B-Reflect, C-Apply) set-out at the start of Part II to increase research rigor by making explicit the choices made in this research, this chapter is structured as follows:

- Section 6.2 describes a search of the literature related to the process, metrics and techniques for the evaluation design science research outputs (such as ontologies).
- Section 6.3 describes the reflection on the choices necessary to design the evaluation activity stream, based on the literature reviewed in section 6.2 and the overall approach to systemic design science (3.5.4).
- Sections 6.4 thru 6.8 describes the details of the evaluation research design as follows:
  - Section 6.4 provides an overview, including identifying the unit of analysis, describing the overall process and discussing issues of research quality.
  - Sections 6.5 thru 6.7 describe the three evaluation activity groups selected: comparative analysis, third-party review and case studies.
  - Section 6.8 describes the activities selected to analyse the results of the evaluation activities.
- Section 6.9 concludes by summarizing the evaluation detailed research design.

6.2 Searching for Best Practices to Undertake Evaluation

Uncovering and analysing the literature on how to best undertake evaluation in systemic design science research turned out to be a time consuming process since the relevant literature comes from multiple fields. Further it has been become clear that the literature on how to best undertake design science evaluations is far from comprehensive and far from prescriptive (and perhaps can never be).

This is perhaps unsurprising given the novelty of the systemic design science approach introduced in Chapter 3.

6.2.1 Reviewing the Literature

With the objectives of this research in mind and in the context created by the overall research design (Chapter 3), the preparation activity stream detailed design (4.2) and results (4.3-4.7) and the build activity stream detailed design (Chapter 5), this section reviews the literature related to the evaluation of:

- Ontologies (from Ontology Engineering),
- Design science artefacts (from Design Science)
- Organizational ontologies that have been produced through design science research (from the exemplars introduced in 3.5.1.3), and
- Root definitions and models (From Soft Systems Methodology Research).

This section is organized as follows:

1. Definitions of and broad perspectives on evaluation are reviewed.
2. Views on the purposes of the evaluation process are presented.
3. Views on the processes that can be used to evaluate artefacts are discussed.
4. The research outputs (artefacts) that require evaluation are described.
5. The metrics that have been used to measure artefacts are explained.
6. The methods and techniques used to capture values for the metrics are considered[1].
7. The contributions to evaluation that are undertaken during other activity streams (preparation and build) are highlighted.

The next section (6.3) describes how the evaluation detailed research design for the SSBMO was chosen based on a reflection and an application this literature. Subsequent sections (6.4-6.8) provide the details of the chosen evaluation detailed research design.

[1] It is only through the capturing of values for the metrics that enable the researcher (and others) to judge whether or not an artefact has met its design goals or not.

6.2.2 *Evaluation: A Definition*

Cleven et. al. (Cleven et al., 2009), propose a "general framework" to design the evaluation of design science artefacts. However, they helpfully begin with a review of antecedents. This begins with a historical review of the role of evaluation within every-day life and more specifically within design science research.

Cleven et. al. note that it is hard to define evaluation. However, synthesizing the definitions of evaluation reviwed, leads to the following working definition:

> Evaluation is the process of determining the worth, merit, significance and opportunities for the improvement of artefacts through the objective and systematic collection of information. Evaluations are the outcomes of that process.

In providing substance to this definition Cleven et al observe that:

- Evaluation may be "quantitative or qualitative, or a mix of these" and that evaluation "is strongly although not always sharply distinct from explanation".
- Accomplishing evaluation is hard work due to challenges with objectivity, comparability and tractability and the complexity inherent in resolving these challenges in a cost and time effective manner.
- These complexities require an "adequate framework […to] support a structure proceeding of the evaluation intentions".
- A variety of different evaluation techniques have been developed from a range of disciplines: Information Systems, Business Administration, Sociology, Computer Science.
- Many researchers have "deplored the absence of appropriate evaluation methods", and that there has been "uncontrolled growth of new methods developed by eager practitioners and researchers" and that many of these "are lacking a theoretical foundation and an empirical validation of their utility". This is particularly observed for artefacts, such as ontologies, created within the Information Systems field.

Hevner & Chatterjee (2010b, pp.109-111) align with the working definition of evaluation: they observe that the process of evaluation, is “rather difficult and complex” process, making reference to the “art” of evaluation (p.111).

Section 3.5.2.2 Soft Design Science Methodology, summarized Baskerville et. al.’s proposed integration of Soft Systems Methodology (SSM) and Design Science (Baskerville, Pries-Heje, & Venable, 2009), based on their observation of how design science and SSM activities are highly similar. This particularly true for design science evaluation activities and SSM comparison activities which clearly serve the same purpose. Baskerville et. al.’s observation also fits well to the working definition above.

Within this idea that soft systems comparison and design science evaluation are the same, Ledington and Ledington’s 1999 paper, introduced in 3.5.4.2, includes a number of useful observations and innovations related to the problems of comparison, which will be discussed in detail below. For now note that Ledington and Ledington align with the design science researchers’ concerns noted above about the poor state of knowledge and practice about evaluation. They state “comparison is problematic both in theory and practice” and go on to call some existing soft systems researchers comparison practices “nonsense”, adding “clearly, knowledge about comparison is inadequate and creates practical difficulties in both transferring the approach to others” (Ledington & Ledington, 1999).

6.2.3 Purpose / Objective of Evaluation

6.2.3.1 Overview

Despite the concerns described above, overall the literature on the purpose of evaluation appears clear and consistent, albeit recent. Summarizing this literature it would seem that:

> The purpose of evaluation within systemic design science research is to rigorously provide feedback on the utility of the designed artefact which is then used to prepare a revised artefact.

Utility is a very broad concept. The research output whose utility should be assessed and the metrics that might measure utility will be discussed in detail in sections 6.2.5 and 6.2.6, after discussing the process of evaluation in section 6.2.4. However, in summary, the literature introduced in 3.5.1.2, suggests that utility includes three basic ideas:

1. Completeness
2. Quality
3. Beauty

6.2.3.2 Supporting Summary of the Literature

The following summary of the literature is provided to support the above definition of the purpose of evaluation in design science and ontology engineering research, and the definition of comparison in soft systems research.

> *Exemplar Organizational Ontologies: The Design Science and Ontology Engineering Perspectives*
>
> The approaches taken to the evaluation activity by the three exemplar organizational ontology researchers, introduced in 3.5.1.3, along with other design science and ontology engineering researchers is presented below.
>
> In his 2004 PhD Osterwalder observed that "of all the authors that presented different business model frameworks only [one] has written about some kind of evaluation having [been] applied" and this was informal, via the use of the framework in consulting work. "None of the authors has set up any hypothesis and tested them in a field setting" (Osterwalder, 2004a, p.142).
>
> Osterwalder suggests that the purpose of evaluation is to compare the designed artefact with the "initial goals of the research" (i.e. the problem that the design is trying to solve) (Osterwalder, 2004a, p.127).
>
> Writing at the same time as Osterwalder, Hevner et. al. (2004, p.82, table 1 p.82) agree with Osterwalder's position, stating that since the designed artefact is

purposeful, it must yield utility (including quality, and efficacy) for the specified problem, i.e. a design artefact must be rigorously demonstrated via well-executed evaluation methods.

> *Evaluation is a crucial component of the research process. The business environment establishes the requirements upon which the evaluation of the artefact is based.*
>
> *A design artefact is complete and effective when it satisfies the requirements and constraints of the problem it was meant to solve* (Hevner et al., 2004, p.85).

Going further than Osterwalder, Hevner et. al also describe how the output of evaluation is used: "the evaluation of the artefact then provides feedback information and a better understanding of the problem in order to improve both the quality of the product and the design process" (Hevner et al., 2004, p.78). i.e. the purpose of evaluation is the "identification of weaknesses in the […] artefact and the need to refine and reassess" (Hevner et al., 2004, p.80).

In 2005 ontology engineering researchers Brank et. al. concurred with this perspective: "Ontology evaluation is the problem of assessing a given ontology from the point of view of a particular criterion of application, typically in order to determine which of several ontologies [i.e. competing design choices] would best suit a particular purpose" (Brank, Grobelnik, & Mladenić, 2005).

Writing four years after Osterwalder and Hevner, Bullinger (2008, p.211) observed that "at present, the field of ontology evaluation is only emerging". She goes on to cite Hevner et. al. (2004) noting that "it is typical for the field that the establishment of a working solution as well as the characterization of the environments in which this artefact works are of primary concern, even if it cannot (yet) be explained completely why the solution works" (Bullinger, 2008, p.216).

Summarizing Osterwalder and March & Smith (March & Smith, 1995; Osterwalder, 2004a) Bullinger states the “objective of the evaluation process is to determine the degree of correctness of the ontology” (Bullinger, 2008, p.213) and that “evaluation means determining whether the design artefacts produced are effective, i.e. achieve their purpose, provide value, and / or produce adverse or unwanted side-effects” (p.220) and that artefacts “should be evaluated before (re)use by one or more applications and users” (p.211).

Concluding on her review of the design science literature Bullinger states that the “objective of the evaluation process is to determine the degree of correctness of the ontology” (p.213) and goes to say that the ultimate evaluation of a designed artefact is its viability and utility in solving the problem that the designed artefact was intended to solve (p.216).

More recently, Cleven et. al. (2009), propose a framework for design science artefact evaluation. This framework is helpful in providing a more granular view of the purpose of evaluation. In this framework they suggest that there are four “closely interweaved” “functions” of evaluation:

1. Acquisition of Knowledge to help put “management decisions on a rational basis”.
2. Gaining *Control* over the utility of the designed artefact.
3. *Development*, based on the learning from the knowledge and control functions, enables the improvement of the artefact through dialog between designer and users.
4. Legitimization of the artefact based on either the process of its design (e.g. ex-anti traceability of antecedents and processes of construction), or the fulfilment of suitable metrics (e.g. ex-post).

A year later, citing a range of antecedents, Al-Debei states “it is important that ontologies are of a good quality, in order that they serve their intended purposes and be shared as well as reused [in] different applications” (Al-debei, 2010, p.17).

Finally, in a recent book chapter focused specifically on evaluation of MIS artefacts in design science, Hevner & Chatterjee state “the designed […] artefact is a social-technical entity that exists within an environment (business and/or social) which lays out the requirements for its evaluation” (Hevner & Chatterjee, 2010b, p.109). Hevner & Chatterjee go on to describe three purposes of evaluation (pp.110-111):

1. *Promotional* – provide evidence of the utility of an artefact to increase the artefact’s subsequent use.
2. *Scholarly* – to uncover the (disciplinary) principles related to the artefact and its use.
3. *Practical* – to provide evidence to designers of the efficacy or efficiency of the content of, and methods or techniques used to build and evaluate the artefact.

The Soft Systems Design Perspective

As noted in 6.2.2, Baskerville et. al. have proposed an integration of Soft Systems Methodology and Design Science (Baskerville et al., 2009). In this paper these authors specifically observe how design science evaluation activities are highly similar to soft systems methodology comparison activities, serving the same purpose: determining whether the designed artefact (that in the case of SSM are root definitions and a model) is fit for purpose.

Overall the purpose of these comparison activities, which occurs in two places in the soft systems method (3.6.3, Figure 3-18), is to ensure the people trying to solve the problem reflexively / dialectically reflect on as many aspects as possible of their problem, their understandings of it, their proposed solutions, and the fit of the real-world to those solutions (Jackson, 2000, p.254; Ledington & Ledington, 1999).

> The intent, through this systemic approach to comparison, is to increase the likelihood, through dialog and single and double loop learning, of uncovering solutions which dissolve the problem for as many of the participants (stakeholders) as possible. SSM solutions ought therefore to be significantly better aligned with more of the participants' world views and hence needs. Such results are believed by many to create solutions superior to those arrived at through imposition or negotiation.

6.2.3.3 Implications for the SSBMO

Considering the literature above from a practical perspective, there are implications for the analysis of any interviews used to gather feedback within a design science research project. Specifically, the idea that the purpose of evaluation is feedback to improve the designed artefact calls into question both the need for and purpose of a 'code book', a typical qualitative research technique, as well as the nature of the 'coding' process required following any interviews used to gather feedback.

In descriptive science research, such as those taking a grounded theory approach, the code book and the coding process are critical in uncovering the evidence gathered from interviews to justify a theory, and to provide a documented chain of evidence from the evidence to the theory.

However, in design science it appears that the use of the evidence gathered during interviews is different. Instead of codes the researcher is looking for feedback (positive and negative) on all aspects of the utility of the designed artefact. Each element of feedback is then used in the subsequent iteration of the build activities, specifically:

- Positive feedback is recorded to support the existing design choices
- Negative feedback is analysed to identify changes to the design which would improve its utility[2].

Clearly as the number of elements of feedback increases from multiple interviews the need for some kind of grouping to aid the researcher in the analysis of negative feedback may be

[2] See the next sections for a discussion of the process of how the feedback is judged positive or negative.

required. While these groups may superficially appear to fulfill a similar purpose to descriptive science codes, they do not.

However as with descriptive science interviews it is important for the researcher to undertake cross-case / meta-analysis. Not all interviewees will provide the same feedback. Some of the feedback will likely be contradictory, based on the interviewee's different world-views. Such feedback is a rich source of insight on artefact utility for the researcher. The researcher will need to synthesize and justify appropriate responses in the revised design to such contradictory feedback.

In synthesising contradictory feedback the researcher needs to be aware that the underlying world-view differences may only be resolved through the researcher undergoing double-loop learning. This means in the subsequent iteration of the build activity, the researcher must not only consider revising existing constructs and relationships in the ontology ('single-loop' learning), but consider revising assumptions made in the selection of these elements and choosing wholly new assumptions and elements ('double-loop' learning).

This is explored in detail in sections 6.2.7 and applied in the evaluation activities which use interviews for gathering feedback (described in 6.6 and 6.7)

6.2.3.4 Assumptions for the SSBMO

Artificial intelligence (AI) ontology engineering makes a distinction between processes of evaluation, validation, verification, assessment and testing (Bullinger, 2008, p.211 footnote #240).

El Debei suggests there are two types of evaluation activities: verification and validation:

1. *Verification mainly refers to technical activities that ensure the syntactic correctness and cleanness of an ontology*
2. *Validation refers to semantic correctness; that is the process of ensuring that an ontology corresponds to the phenomenon that it is supposed to represent.*
   (Al-debei, 2010, p.61)

The differences are, according to these authors, because for AI and highly formalized (computerized) ontologies many of these processes can be undertaken by a computer.

In this research these processes are taken as synonyms of evaluation.

6.2.4 Process of Evaluation

6.2.4.1 Overview

Having defined evaluation and described its purpose we now turn to reviewing the literature about how to undertake evaluation, i.e. the process of evaluation.

The problem of identifying an appropriate process of evaluation can be stated as follows:

> What are the appropriate steps required to understand the utility (completeness, quality and beauty) of the designed artefact?

The literature makes it clear that there is no line that demarcates the contribution of each evaluation step to answering this question, since these steps occur during all stages of the research process. There is general recognition that the 'main' evaluation steps are undertaken during the research stage labelled 'evaluation', i.e. the steps that gather the feedback on the designed artefact (see Figure 3-6, the information system research framework and Figure 3-7, the design science research cycle).

However, it is also recognized that steps taken during the preparation activity stream (discussed in 4.2.1.5) and build activity stream (discussed in 5.2.5.2) and the steps that develop an evaluation research design (6.3-6.8) also strongly contribute to the rigour and validity of the evaluation activity.

Table 6-1 summarizes the literature's suggestions for the steps appropriate to undertake a rigorous evaluation.

Further, the literature strongly suggests that evaluation be part of an iterative process of building and evaluation: either within a single research project, or over multiple projects.

This recommendation was noted in 3.5.4.3 and subsequently incorporated in the overall research design Figure 3-16.

Recommended Evaluation Step…	**…Undertaken in Which Research Activity Group**
1. A clear understanding of the problem that is to be solved by the creation of a novel artefact (i.e. what is the desired increase in utility, and what is the justification / antecedents for the composition of the design)	Prepare / Build
2. State exclusions / limitations of the artefact and design principles applied to its construction	Prepare / Build
3. Surface designer and user context for build and evaluate activities (i.e. the expectations, desirability, and importance of the artefact relative to the problem and its solution)	Prepare / Build
4. A formal approach to the definition of the artefact and any accompanying description	Build
5. Use satisfactorily passing CATWOE evaluation test3 as a gating item for the completion of an iteration within the build activity	Build
6. The development of explicit criteria (metrics and expected values) of the desired utility (completeness, quality, beauty) prior to gathering the values of the metrics (i.e. the feedback itself).	Prepare / Build / Evaluate
7. The identification of the techniques to be used to collect the values of the metrics (the feedback) prior to undertaking this work.	Prepare / Evaluate
8. Collecting the values of the metrics (i.e. gathering the feedback)	Evaluate
9. Comparison of the actual utility (completeness, quality and beauty) against the specifications of desired utility	Evaluate
10. Developing arguments to determine how to apply the results of the comparison of actual vs. desired utility to the improvement of subsequent iterations of the designed artefact	Evaluate / Build
11. Communicating: the results of the comparison; the arguments to support changing not or not changing the artefact; and the results of any changes made to the artefact	Communication

Table 6-1: Recommended Evaluation Steps and the Research Stage When They Should be Undertaken

6.2.4.2 Supporting Summary of the Literature

The following summary of the literature is provided to support the recommended steps required to undertake a rigorous evaluation of a design science artefact (Table 6-1).

[3] Introduced in 5.2.5.2 Testing Definitions of Constructs and Their Interrelationships

The Design Science and Ontology Engineering Perspectives

Summarizing the position of evaluation within design science research Hevner and Chatterjee state: "A designer finds a suitable and interesting problem to solve. They come up with design solutions. That is followed by the build phase. After they have built the artefact, the next phase is evaluating for efficiency, utility or performance" (Hevner & Chatterjee, 2010b, p.109).

Al-Debei concurs, asserting that the outcome of such an evaluation phase of an ontology design science research project should include a "successfully developed ontology (i.e. syntactically correct, well-structured, consistent), and the development of a "semantically rich ontology compliant with the real world phenomenon" (Al-debei, 2010, p.39). In turn this will "ensure […] it performs correctly in the real world" (Al-debei, 2010, p.43).

Stressing that the evaluation stage is a part of an iterative approach that is central to design science Al-Debei states: "design science research stresses the importance of iterations [of building and evaluating] in producing the design artefacts and assumes that reality and knowledge emerge throughout the iterations" (Al-debei, 2010, p.29).

At a more detailed level, Hevner and Chatterjee state that the process of "evaluation should be viewed as an exercise in argument, rather than as a demonstration, because any study appears equivocal when subjected to serious scrutiny" (p.113). Writing from a management science, rather than information systems perspective, Van Aken agrees by stating that "evaluation research follows intervention-outcome logic and is by its very nature testing-in-context" (van Aken, 2004, p.234).

Hevner in two separate papers with different co-authors describes the overall steps involved in evaluation as "the definition of appropriate metrics and […] the gathering and analysis of appropriate data." to justify the utility, quality and efficacy of the artefact at solving the problem. (Hevner et al., 2004, p.85; Hevner & Chatterjee, 2010b, p.109).

This aligns well with Bullinger's (2008, p.220) summary of Osterwalder (2004) and March & Smith (1995). Bullinger states that the process of evaluation "encompasses a) the development of criteria [metrics and values] and b) the assessment of artefact performance against those criteria."

In the later paper by Hevner (with Chatterjee) these authors suggest the detailed but generic steps shown in Figure 6-1 should be the basis for designing a design science evaluation process.

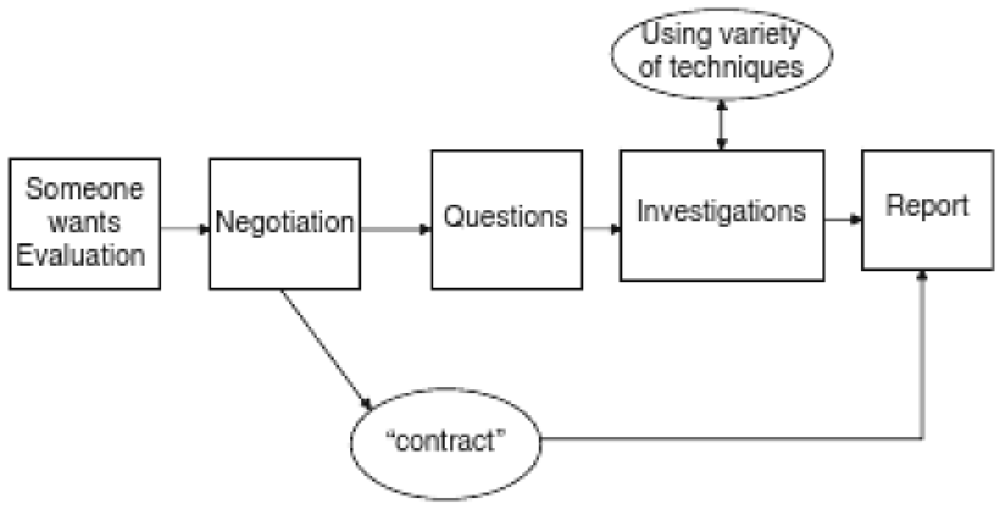


Figure 6-1: Generic Steps for Evaluating a Designed Artefact
(Hevner & Chatterjee, 2010b, Fig.9.2 p.112)
With kind permission of Springer Science+Business Media

Within these steps Hevner et. al describe how rigor and the quality of the evaluation process, and hence of its outcome, is achieved: "methodologies provide [the] guidelines used [during] evaluation" and that "rigor is achieved by appropriately applying existing methodologies [during evaluation]" (Hevner et al., 2004, p.80).

Aligned with this perspective, Al-Debei suggests that establishing the methodology for evaluation prior to undertaking these steps is critical to achieving rigor: "It is important to set up a quality system that incorporates objective criteria to […]

evaluate the constructed design artefact", and that this "affects the quality of the final artefact as well as its validity" (Al-debei, 2010, p.43).

Al-Debei notes that "this area is still insufficiently explored" and claims his approach, the establishment of a Design Quality and Evaluation Framework prior to commencing the build of the artefact (i.e. during Preparation) is a contribution of his research (Al-debei, 2010, p.43).

However, writing from an ontology engineering perspective Brank cautions that "there is no single best or preferred approach to ontology evaluation; instead, the choice of a suitable approach must depend on the purpose of the evaluation, the application in which the ontology is to be used, and on what aspect of the ontology we are trying to evaluate" (Brank et al., 2005).

To attempt to provide more specific direction to researchers, to help increase the rigour and quality of research designs Cleven et. al offer a range of advice based on their summary of the design science evaluation literature. Cleven et. al. state, that the purpose of design science is to produce solutions that have utility, and that

> *In order to achieve utility when developing a design science research artefact two fundamental requirements must be fulfilled:*
>
> – *Relevance – achieved when the artefact actually addresses a real business need*
> – *Rigor – assured by appropriately applying the existing methodologies* (Cleven et al., 2009)

To provide the level of guidance they felt researchers needed Cleven et. al developed a general framework for the design of the evaluation steps for design science artefacts. Their objective was to ensure the relevance and rigour requirements are considered and fulfilled by design science evaluation research designs. This framework consists of 12 "variables" for which the researcher is required to choose "values" in the process of designing their evaluation approach. In Table 6-2 the possible values are presented as:

- Book-ends, and/or multiple points on continuums (shown by ellipses '…' between possible values) or
- Discrete choices (shown by commas between possible values).

Cleven et. al. state their design objective for constructing the list of variables in their framework was to "get a set of [evaluation] dimensions that is as small as possible and as large as necessary" and to use these to discuss methods that could be employed by others to validate their proposed set of evaluation steps which meets these conditions."

Cleven et. al. use this framework to structure their review of a number of recent design science research projects described in the special issue on Design Science research of the leading Management Information Systems journal (MIS Quarterly, 2008, v32 issue 4). They claim completeness of their framework for the context of information systems research, such as ontology development.

Variable	Possible Values
Ontology[4]	Essentialist…Anti-foundationalist
Epistemology[5]	Positivism…Anti-Positivist
Research Purpose[6]	Exploration, Explanation, Description, Prediction
Approach	Qualitative…Quantitative
Object	Artefact and/or Artefact Construction Process
Artefact Focus	Technical…Organizational… Strategic
Time	Ex-ante…Ex-post
Reference Point	a. Artefact against Research Gap, b. Artefact against "Real World", c. Research gap against "Real World"
Position	Externally (others only)…Internally (researcher only)
Artefact Type	Construct, Model, Method, Instantiation, Theory
Function (purpose of metric)	Knowledge…Control… Development…Legitimization
Perspective (type of metric)	Economic…Deployment… Engineering…Epistemological
Method/Technique	examples: Action Research, Case Study, Field Experiment, Formal Proof, Controlled Experiment, Prototype, Survey

Table 6-2: Framework for Designing Design Science Evaluation Research
(Adapted from Cleven et. al.Cleven et al., 2009, table 1)[7]

[4] This is the philosophical / metaphysical use – "nature, its essential properties, relations of being and the organization of reality" (Bullinger, 2008, p.138), see Table 3-1.
[5] See Table 3-1.
[6] Added based on Yin (2009) and Shields (Shields & Tajalli, 2006, p.317).

The Soft Systems Perspective

The introduction to the integration of Soft Systems Methodology and design science (3.5.2.2 Soft Design Science Methodology), noted there are two evaluation activities which occur in SSM (Figure 3-13), which in design science terms evaluate different design science research output elements being evaluated. This implies that the type of knowledge about the problem being used to conduct the evaluation, the comparator knowledge (introduced in 3.2.3.4) and the potential sources of that knowledge will also need to vary to maximize rigor and output legitimacy.

The possible combinations of types of evaluation in SDM, along with the comparator knowledge types required and the research output elements are summarized in Table 6-3.

Evaluation Type		**Type of Knowledge**	**Research Output Elements Being Evaluated**
A.	Step 5 – cycle n	Generalized knowledge of the problem space, i.e. key theoretical frames (3.2.3.3): "truths" about the "real-world" distilled by descriptive science in t (K0)	Constructs (SSM root definitions), Models and Example Instantiations
B.	Between Step 7 – cycle n, and Step 1 cycle n+1	Specific knowledge of an example of the problem, i.e. comparator knowledge (3.2.3.4): the relevant part of the "real-world" gathered during the research (K1…n).	Specific Instantiations

Table 6-3: Types of Evaluation in Soft Design Science

Further to meet the purpose of the evaluation from a soft systems perspective (see 6.2.3.2 The Soft Systems Perspective), it is critical that both the generalized and the

[7] The article has a detailed description of each of the values (Cleven, Gubler, & Huner, 2009, pp.2-5). Note that a normative perspective is assumed by Cleven et. al, since it is inherent in the design science approach, and hence is not included as one of the variables.

specific knowledge of the problem come from sources with a diversity of world-views.

Concluding Literature Review of Evaluation Process

In their up-to-date and comprehensive review of design science research (philosophy, epistemology, methodology, etc.) Vaishnavi and Kuechler provide a comprehensive overview of the evaluation process and a useful comparison of design science evaluation to descriptive sciences hypothesis testing:

> *Once constructed, the artefact is evaluated according to criteria that are always implicit and frequently made explicit in the [evaluation process design]. Deviations from expectations, both quantitative and qualitative are carefully noted and must be tentatively explained. That is, the evaluation phase contains an analytic sub-phase in which hypotheses are made about the behaviour of the artefact. This phase exposes an epistemic fluidity that is in stark contrast to a strict interpretation of the positivist stance. At an equivalent point in positivist research, analysis either confirms or contradicts a hypothesis. Essentially, save for some consideration of future work as may be indicated by experimental results, the research effort is over. For the design science researcher, by contrast, things are just getting interesting! Rarely, in design science research, are initial hypothesis concerning behaviour [of the artefact in context] completely borne out. Instead, the evaluation phase results and additional information gained in the [build of the] artefact are brought together and fed back to another round of [prepare, build, evaluate, communicate] […]. The explanatory hypotheses, which are quite broad, are rarely discarded, but rather are modified to be in accord with the new observations. This suggests a new design, frequently preceded by new library research [prepare] in directions suggested by deviations from theoretical performance"* (Vaishnavi & Kuechler, 2009,"Design Science Research Methdology").

Concurring with a number of other researchers, Vaishnavi and Keuchler note this process frequently occurs over several research projects, each iterating on the results of the prior project, rather than within a single research project! This reflects the cognitive load that evaluation places on the researcher.

6.2.5 Research Outputs Requiring Evaluation

Having defined evaluation, described its purpose, and reviewed the steps to undertake evaluation, the literature is reviewed to determine the detail of what needs to be evaluated, i.e. the output, or artefacts, from the build activities.

All the design science authors consulted relied on the works of March & Smith (often amended by Viashnavi) to identify the research outputs that required evaluation: i.e. constructs, models, instantiations, method and better theories (3.4.7.1, Table 3-5).

For example:

- Osterwalder (2004, p.127) states that "constructs, models, methods and instantiations built […] should be evaluated with an appropriate method according to the initial goals of the research".
- Bullinger (2008, p.224) concurs, stating that the output of the build activity is an artefact consisting of constructs, models, methods and instantiations that require evaluation.

However, researchers note that not all design science research projects produce all types of output, and hence the scope of the items to evaluate and the applicable metrics and techniques to conduct a rigorous evaluation may vary. For example Osterwalder states "in this dissertation I essentially concentrate on evaluating the constructs and the model as it is the major outcome and contribution of this research" and "in this thesis instantiations are simply illustrated through cases, though this at least proves their applicability" (Osterwalder, 2004a, p.127).

Finally, as noted in 3.5.2.2 (The Proximity of Design Science and Systems Thinking) there is high degree of alignment of the notions of constructs, models and instantiations, the outputs of Design Science research and the notions of root definitions, models and solution construction, the outputs of Soft Systems Methodology research (Baskerville et al., 2009).

6.2.6 Evaluation Metrics

6.2.6.1 Overview

Having defined evaluation, described its purpose, reviewed the steps to undertake evaluation, and described what needs to be evaluated, the next question is how the general concept of the utility of the design artefact can be measured in practice.

There are two aspects of measurement. In this section the literature related to what needs to be measured to evaluate utility is systematically reviewed, i.e. the metrics.

In the next section (6.2.7) the literature related to how a researcher can gather values of those metrics is systematically considered, i.e. the techniques that can be used to collect values of the metrics.

6.2.6.2 Selecting Metrics

The literature reviewed (see Table 6-4) offered limited advice to researchers on how to select the metrics for evaluation.

For example, when advising on selecting metrics to evaluate artefacts Hevner et. al suggest that all metrics should be relevant to the artefact and the problem to be solved by that artefact. Hence, it is up to the researcher, based on the problem their artefact is designed to solve, to justify their selection of metrics, to understand possible values of those metrics, and to choose methods/techniques for getting values of those metrics. (Hevner et al., 2004, p.85, pp.82-90).

More recently Hevner & Chatterjee advised that metrics should be identified that reflect different stakeholders since “different stakeholders often have different perspectives […] they all look at the same [artefact] with different viewpoints” (Hevner & Chatterjee, 2010b, p.111). This aligns well with the earlier analysis (6.2.4.2) of the soft systems perspective on evaluation. This stressed the importance of a variety of sources and a variety of types of knowledge against which the artefact should be compared, for the same reasons.

Hevner and Chatterjee go on to suggest evaluation questions (i.e. a combination of a metric and a technique for eliciting a value of that metric) may vary depending on the stakeholder, and give the following examples:

- *Users: will it help me? Is it safe? Is it fast enough? Is it accurate enough? Is it easy to use?*
- *Designers: does it work according to specification? Which function would users really like to see? Will users actually derived the intended benefit from use?*
- *Funders: Is the cost / benefit ratio appropriate? Does the artefact have the right attributes to earn an appropriate return on investment?*
  (Hevner & Chatterjee, 2010b, p.111)

Rounding out researchers' perspectives on the challenges of selecting metrics, Bullinger notes that there can be conflict between metrics. For example metrics that consider "degree of correctness according to formal criteria might support the decision to use an ontology, but [do] not provide information on the usability for a particular purpose" (Bullinger, 2008, p.215).

March et. al note that it can be difficult to select metrics to evaluate instantiations because "it is hard to separate instantiations from the constructs, models and methods which they embody" (March & Smith, 1995).

Finally, in the same paper, March et. al. note that in design science selecting metrics for "evaluation is complicated by the fact that performance is related to intended use, and the intended use of an artefact can cover a range of tasks" (March & Smith, 1995, p.254).

6.2.6.3 Possible Metrics to Choose From

Because of the lack of guidelines in the literature about what metrics to choose and how to select amongst different metrics it was determined that it would be valuable to review the literature systematically in order to better able to understand and justify the metrics to be used in this evaluation detailed research design (Jesson, 2011, p.15).

Approach to Identifying Metrics

To identify the possible metrics to choose from in the evaluation research detailed design a range of literature searches were conducted in a range of sources pertaining to ontology engineering, design science, and soft systems, and combinations of these topics.

This resulted in the population of sources being deemed relevant, listed in Table 6-4.

These sources were then subject to a systematic literature review as per the techniques introduced in Chapter 4 (Jesson, 2011, p.15). The results of this review are presented below.

Count of This Type of Source	Source Type	Reference
2	Ontology Engineering Journal Article	(Brank et al., 2005; Vaishnavi & Kuechler, 2009)
3	MIS Design Science Research Journal Article	(Hevner et al., 2004, p.81, table 1 p.82, p.85; Hevner & Chatterjee, 2010b, p.109, p.111; March & Smith, 1995)
1	MIS Design Science Ontology PhD	(Osterwalder, 2004a, pp.127-128)
1	MIS / Operations Research Journal Article	(Ormerod, 1995)
1	MIS / Innovation / Strategy Design Science Ontology	(This research, earlier iteration of research design)[8]
2	Design Science Conference Proceedings	(Baskerville et al., 2009; Cleven et al., 2009)
1	Innovation / Entrepreneurship Design Science Ontology PhD	(Bullinger, 2008, p.200, pp.211-216, p.220, p.224, p.248, p.249 ,table 71 p.250, table 71 p.251)
1	Strategy Design Science Ontology PhD	(Al-debei, 2010, p.17, p.39, pp.43-46, p.61)
1	Monograph on Design Science and the Science of Design	(Simon, 1996, first published 1969)
1	Systems Methodology Text Book	(Jackson, 2000, p.254)
2	Systems Research Journal Article	(Assimakopoulos & Riggas, 2006; Ledington & Ledington, 1999)
1	Case Study Research Design Text Book	(Yin, 2009, Figure 2.3 p.40-45)
17	***Total Number of Sources***	

Table 6-4: Types and Counts of Metrics Literature Consulted

Summary Results of Identifying Metrics

In these 17 sources 83 different metrics were identified by the authors. Metrics were counted as identical when the interpreted meaning in the context of the sources suggested they were highly similar.

[8] The initial metrics selected for this research were included in the review to provide feedback on the validity of the choices made earlier in this project when compared to a much larger selection of the literature.

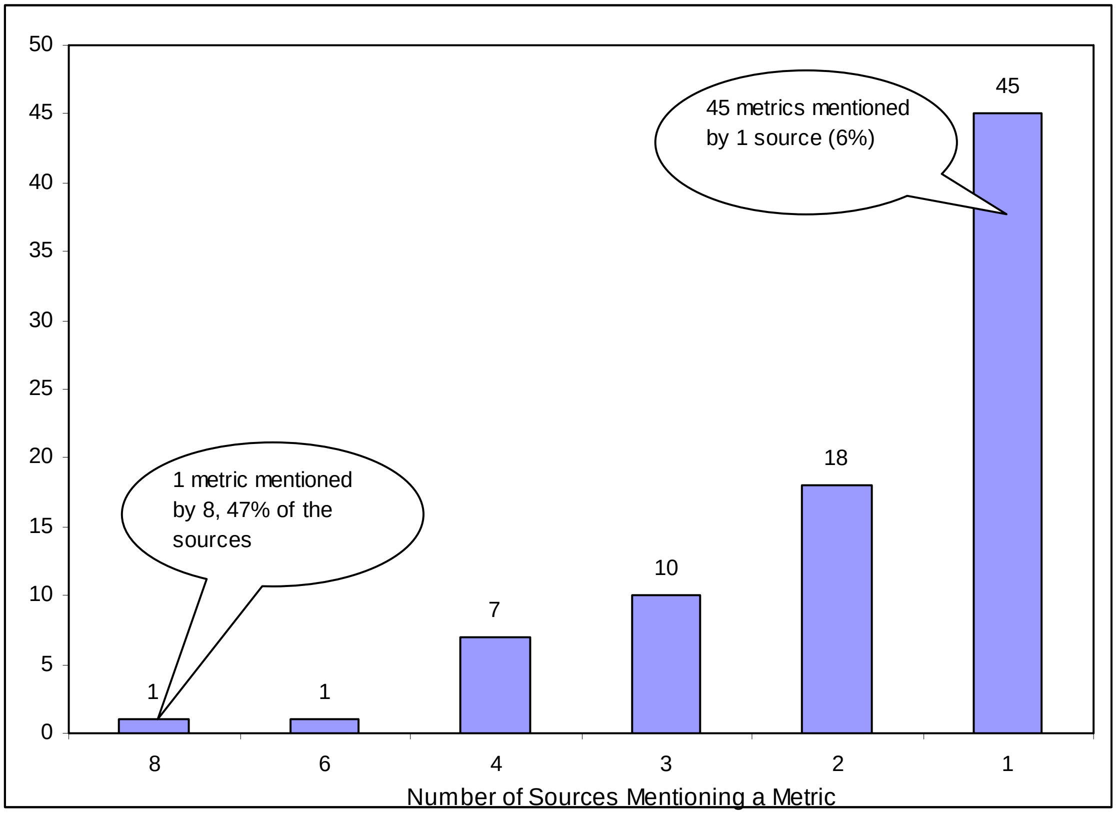


Figure 6-2: Number of the 83 Metrics Mentioned By How Many of the 17 Sources

Of the 83 metrics the sources provided a formal definition for only 24 (29%). When a metric was mentioned by multiple sources a definition was only given in one of the sources. Further, where a definition was given, in most cases little or no advice on applicable measurement techniques or their use was provided.

Of the sources that described the author's own research (as opposed to sources which only discussed methodology), the number of metrics mentioned vs. the number of metrics used in the researcher's own evaluation phases was generally not described. Sources that mentioned a high number of metrics did so only discursively.

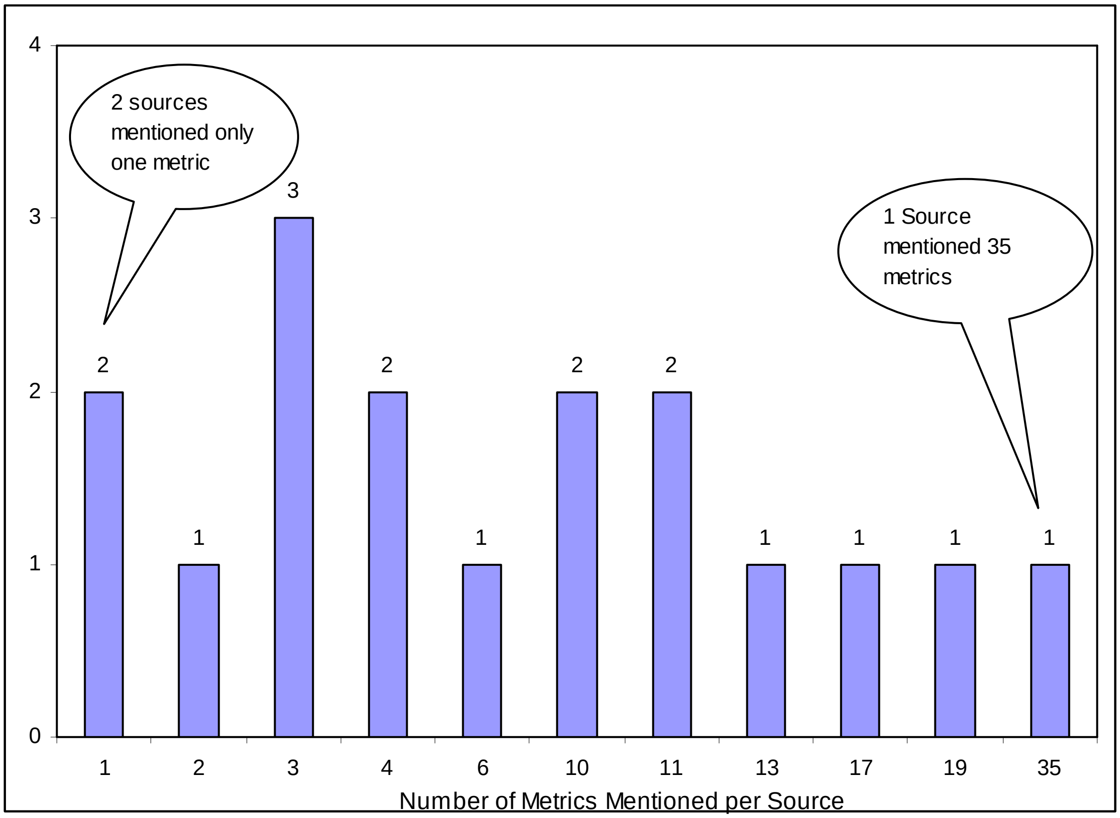


Figure 6-3: Number of the 17 Sources Mentioning How Many of the 83 Metrics

Purpose of Metrics Identified

A textual analysis of the literature suggested that 79 of the 83 metrics were conceived to elicit positive / confirmatory feedback. 11 of these metrics were conceived to elicit negative / opportunity for improvement feedback. 7 of these metrics (i.e. 7 of the 79 and 7 of the 11) where conceived as complementary dyads of metrics to elicit both positive and negative feedback.

5 of the metrics mentioned were specifically conceived to elicit feedback about all three of the typical design science research outputs (constructs, models and instantiations). For 35 of metrics mentioned there was no specification of which design science research outputs the metrics was intended to elicit feedback about. The remaining 43 metrics mentioned were conceived to elicit feedback about

differing combinations of design science research outputs (i.e. some sources would say a metric was conceived to elicit feedback about constructs, another source would suggest the same metric was conceived to elicit feedback about instantiations).

Grouping and Cataloguing of Metrics Identified

A textual analysis of the literature, supported by an excel spreadsheet, identified two broad groups of metrics and recorded all the detailed citations from the 17 sources.

The first group, shown in Table 6-5, are metrics designed to give feedback about the designers and users context for the evaluation. 3 of the 83 metrics (4%) were in this group.

Metrics Conceived to Elicit Positive / Confirmatory Feedback	**Associated Metric Conceived to Elicit Negative Feedback / Opportunity to Improve Design**	**Recommendation on Applicability to Which Design Science Research Output**
High expectation of likeness relationship between situation and model	Low expectation of likeness relationship between situation and model	Model
High desirability of the model in relation to the situation	Low desirability of the model in relation to the situation	Model
High importance of the model in relationship to identifying relevant change in a situation	Low importance of the model in relationship to identifying relevant change in a situation	Model

Table 6-5: Metrics Designed to Give Feedback on the Context of an Evaluation

The second group are metrics designed to give feedback about the utility of the artefact, implicitly or explicitly against a set of criteria. 11 of the 83 metrics (13%) were designed to give generic feedback about utility (shown in Table 6-6).

Metrics Conceived to Elicit Positive / Confirmatory Feedback	Associated Metric Conceived to Elicit Negative Feedback / Opportunity to Improve Design	Recommendation on Applicability to Which Design Science Research Output
Build approach		All
Objectivity of evaluation		All
Suffices the requirements		Constructs, Model, Instantiations
Achieves the purpose		Undefined
Useful, Has Utility (to the intended user)		Undefined, Instantiation
Acceptable		Undefined
Viable		Undefined
Provides value		Undefined
Provides insight		Undefined
	Produces adverse or unwanted side effects	Undefined, Instantiation
Satisficing (good enough, not necessarily optimal)	Not Optimal	Undefined, Instantiation

Table 6-6: Metrics Designed to Give Generic Feedback on the Utility of the Artefact Being Evaluated

Also in this second group of metrics designed to gather feedback on utility of the designed artefact, the textual analysis of the literature suggested that the remaining 69 metrics (83%) could be grouped into the three dimensions of utility introduced earlier (see 6.2.3.1), as follows:

- Completeness (7, 10%),
- Quality (57, 69%)
- Beauty (4, 5%)

Within each of these three dimensions of utility, like metrics were placed into one of these groups based on tacit knowledge of their definitions. The metrics of completeness are shown in Table 6-7. The metrics of quality are shown in Table 6-8. The metrics of beauty are shown in Table 6-9.

Metrics Conceived to Elicit Positive / Confirmatory Feedback	Associated Metric Conceived to Elicit Negative Feedback / Opportunity to Improve Design	Recommendation on Applicability to Which Design Science Research Output
Truth		All
Completeness	Incompleteness	Undefined, Constructs, Model, Instantiations
Level of detail		Model, Instantiation
Identity		Constructs, Model, Instantiations
Unity		Constructs, Model, Instantiations
Generality		All, Model, Method
External validity		Undefined

Table 6-7: Metrics Designed to Give Feedback on the Completeness Aspect of the Utility of the Artefact Being Evaluated

Metrics Conceived to Elicit Positive / Confirmatory Feedback	Associated Metric Conceived to Elicit Negative Feedback / Opportunity to Improve Design	Recommendation on Applicability to Which Design Science Research Output
Quality		Undefined
Good		All
Correctness	Incorrect	Constructs, Model, Instantiations
Validity		Construct
Accuracy		Undefined
Precision		Undefined, Constructs
Fidelity with reality / real-world		Instantiation, Model
Compliant with real world phenomenon		Undefined
Applicability		Undefined
Meaningfully		Undefined

Metrics Conceived to Elicit Positive / Confirmatory Feedback	Associated Metric Conceived to Elicit Negative Feedback / Opportunity to Improve Design	Recommendation on Applicability to Which Design Science Research Output
Efficiency		Undefined, Model, Instantiation
Performative		Undefined
Fit for Purpose		Instantiation
Operationality		Method
Reliability		Undefined
Superiority		Undefined
Lastingness		Undefined
Effective		Undefined, Method, Instantiation
Efficacy		Undefined
Appropriateness		Undefined
Fit (of artefact) within the Organization	Lack of Fit within the organization	Undefined
Organizational likeness to artefact		Model
Structural fit		Model
Suitability		Undefined
Soundness		Undefined
Robustness		Model, Instantiation
Ease of Use		Constructs, Model, Method
Usability		Undefined
Recall		Undefined, Constructs
Average response time		Undefined
Functional / Functionally Complete / Functionality		Undefined
Technological		Undefined
Expandability		Constructs, Model, Instantiations
Customizability / Versatility / Adaptability		Undefined
Flexibility		Undefined
	Rigidity	Constructs, Model, Instantiations
Cleanliness		Constructs, Model, Instantiations
Simplicity		Constructs
Level of Detail		Model, Instantiation
Essentiality		Undefined
Comprehensibility		Constructs
Clarity		Undefined
Coherent		Undefined
Conciseness	Redundant	Undefined, Constructs, Model, Instantiations
Well structured		Undefined
Descriptiveness		Constructs
Language conformity (quality of syntax)		Constructs, Model, Instantiations

Metrics Conceived to Elicit Positive / Confirmatory Feedback	Associated Metric Conceived to Elicit Negative Feedback / Opportunity to Improve Design	Recommendation on Applicability to Which Design Science Research Output
Syntactically correct (consistent formalism)		Undefined
Consistency	Inconsistent	Undefined, Constructs, Model, Instantiations
Language consistency (quality of semantics)		Constructs, Model, Instantiations
Semantic Preciseness and Richness		Undefined
Internal consistency		Undefined, Model, Instantiation
Integrity		Undefined
Internal Validity		Model
Sensitive		Constructs, Model, Instantiations
Operating Cost		Undefined

Table 6-8: Metrics Designed to Give Feedback on the Quality Aspect of the Utility of the Artefact Being Evaluated

Metrics Conceived to Elicit Positive / Confirmatory Feedback	Associated Metric Conceived to Elicit Negative Feedback / Opportunity to Improve Design	Recommendation on Applicability to Which Design Science Research Output
Beautiful		All
Elegance		Constructs
Style		Undefined
Structure, Architecture, Design		Constructs, Model, Instantiations

Table 6-9: Metrics Designed to Give Feedback on the Beauty Aspect of the Utility of the Artefact Being Evaluated

Definitions for Identified Metrics

As mentioned above, of the 83 metrics the sources provided a formal definition for only 24 (29%). These definitions are shown in Table 6-10.

Freq. this Metric Proposed	Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design	Proposed Applicability to Which Design Science Research Output	Definition of Metric - if provided
1	Context				In order to be certain that evaluation is being conducted rigorously (Jackson, 2000) it is key for the persons undertaking the comparison be as fully aware as possible of the context for their evaluation (Ledington & Ledington, 1999, pp.333-334). The three contexts are below.
1	Context	High expectation of likeness relationship between situation and model	Low expectation of likeness relationship between situation and model	Model	"The comparison [SSM evaluation] activity operates in the context of some, often implicit expectation of a likeness relationship between situation and model" (Ledington & Ledington, 1999, p.333). "For any relevant [artefact] it is possible ask 'what degree of expectation is associated with the model? Do we expect it to be like the situation?'" (Ledington & Ledington, 1999, p.334)
1	Context	High desirability of the model in relation to the situation	Low desirability of the model in relation to the situation	Model	"That comparison will be carried out in a context in which the relevant system/model has some, often implicit, desirability in relationship to the situation" (Ledington & Ledington, 1999, p.334). "For any relevent [artefact] it is possible ask 'is it desirable or undesirable?'" (Ledington & Ledington, 1999, p.334)
1	Context	High importance of the model in relationship to identifying relevant change in a situation	Low importance of the model in relationship to identifying relevant change in a situation	Model	"Comparison will operate in a context which a model is seen to have importance in relation to identifying relevant change in a situation" (Ledington & Ledington, 1999, p.334). "For any relevant [artefact] it is possible ask 'Is it important or unimportant?'" (Ledington & Ledington, 1999, pp.334)
1	Generic	Build approach		All	Cleven suggests that the quality of the knowledge base and the way it is applied during the build impacts the quality of the evaluation (Cleven et al., 2009).
8	Generic	Useful, Has Utility (to the intended user)		Undefined, Instantiation	"Ability to for a manager to recognize and reason with their firm's actual or desired business models – irrespective of intended level of sustainability" (Upward, 2011. "Research Proposal Version 4.1").
1	Generic	Viable		Undefined	"A viable artefact extends the knowledge base or applies existing knowledge in an innovative way" (Bullinger, 2008, p.224)

Freq. this Metric Proposed	Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design	Proposed Applicability to Which Design Science Research Output	Definition of Metric - if provided
1	Generic	Provides insight		Undefined	"The appropriate question [is] 'To what extent is it meaningful to think of the situation in terms of the language of the model?' In other worse, what are the implications of conceptualizing the situation in the terms expressed in the model?" (Ledington & Ledington, 1999, p.338).
6	Comp-leteness	Completeness	Incomplete-ness	Undefined, Constructs, Model, Instantiations	"Incompleteness is a fundamental problem with ontologies. In fact, completeness cannot be proven, but incompleteness of particular definitions (resulting in incompleteness of the ontology) and incompleteness of an ontology (if at least one definition is missing) can be shown. Completeness is given if and only if all that is supposed to be in the ontology is explicitly stated or can be inferred and if each definition is complete (i.e.: Is the required knowledge (not) explicit? If it is not explicit, can it be inferred? (Bullinger, 2008, p.213 citing Gómez-Pérez, 2004) "It is believed in this research that it is more convenient to verify the completeness of an ontology in an inverse way; that is by asking questions of the 'what is missing?' type. Incompleteness means that one or more central parts or hallmarks of the investigated phenomenon are not set out explicitly or cannot be inferred through established definitions and axioms" (Al-debei, 2010, pp.43-46).
4	Comp-leteness	Level of detail		Model, Instantiation	Unclear if Bullinger or March, who introduce this metric, means this metric to be defined from the perspective of "not enough" detail (i.e. completeness) and/or "not simple" (i.e. unnecessary detail) (Bullinger, 2008; March & Smith, 1995)
1	Comple teness	External validity		Undefined	i.e. defining the domain to which a study's findings can be generalized (Yin, 2009, Figure 2.3 p.40-45)
1	Quality	Validity		Construct	i.e. identifying correct operational measures for the concept being studied (Yin, 2009, Figure 2.3 p.40-45)

Freq. this Metric Proposed	Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design	Proposed Applicability to Which Design Science Research Output	Definition of Metric - if provided
3	Quality	Precision		Undefined, Constructs	Al-Debei states: “avoiding ‘encoding bias’ by founding conceptualization at the knowledge-level rather than the symbol level. In other words, representation decisions should not be made based only and dominantly on the convenience of notation.” (Al-debei, 2010, pp.43-46, citing Gruber 1995)
3	Quality	Reliability		Undefined	i.e. demonstrating that the operations of a study – such as the data collection procedures – can be repeated, with the same results.” (Yin, 2009, Figure 2.3 p.40-45)
1	Quality	Organizational likeness to artefact		Model	"To what extent is their a likeness between the model and the situation; that is to what extent can the situation be conceptualized in terms of the elements expressed in the conceptual model" (Ledington & Ledington, 1999,p333). This is opposite of the metric identified by some (Fit to organization) which these authors suggest is a "nonsense" metric for quality of the artefact, since "the conceptual model [the SSM artefact] is built entirely from a root definition and structured according to logic. Why should some version of this model exist in reality? Indeed what is the mechanism by which such a model causes a version of itself to exist?"
1	Quality	Expandibility		Constructs, Model, Instantiations	The criterion of expandability refers to the effort required to add new definitions and to add more knowledge to existing definitions. Sensitiveness relates to how small changes in a definition change its set of properties (Bullinger, 2008, p.213 citing Gómez-Pérez, 2004).

Freq. this Metric Proposed	Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design	Proposed Applicability to Which Design Science Research Output	Definition of Metric - if provided
1	Quality	Customizability / Versatility / Adaptability		Undefined	Al-Debei (2010, pp.43-46, citing Gruber 1995) states Customizability is also sometimes called "versatile" (p.85) and "adaptable" (p.86) and goes on to state that "the conceptual foundation should be designed in a way that leaves room for different users to monotonically instantiate and specialize the ontology so as to fit their particular settings. In other words, an ontology needs to be designed in a way that gives its different users the ability to expand the existing shared vocabulary without altering the existing ones." This happens when "only constructs (objects and relationships) that are critical and crucial to the communication of knowledge consistent with theory. This would lead to a sufficiency state where the representation level is adequate."
2	Quality	Level of Detail		Model, Instantiation	Unclear if Bullinger or March, who introduce this metric, means this metric to be defined from the perspective of "not enough" detail (i.e. completeness) and/or "not simple" (i.e. unnecessary detail) (Bullinger, 2008; March & Smith, 1995)
1	Quality	Clarity		Undefined	Al-Debei (2010, pp.43-46 citing Gruber, 1995 and Noy and McGuinness, 2001) states "an ontology needs to successfully and objectively communicate the intended meaning of defined terms. Defined terms are concepts describing the domain, which will most likely be nouns (i.e. objects), or verbs (i.e. relationships). Creating a list of these terms is important, as well as documenting their definitions in natural language [impacts human understanding / communication]".
2	Quality	Coherent		Undefined	Al-Debei (2010, pp.43-46) states "if a sentence that can be inferred from the axioms contradicts a definition or example given informally, then the ontology is incoherent" or "a given definition is consistent if and only if the individual definition is consistent and no contradictory sentences can be inferred using other definitions and axioms".

Freq. this Metric Proposed	Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design	Proposed Applicability to Which Design Science Research Output	Definition of Metric - if provided
2	Quality	Conciseness	Redundant	Undefined, Constructs, Model, Instantiations	"A concise ontology does not store any unnecessary or useless definitions, does not contain explicit redundancies between definitions, and redundancies cannot be inferred from other definitions and axioms (Bullinger, 2008, p.213 citing Gómez-Pérez, 1995 and Gómez-Pérez, 2004) The ontology does not contain unnecessary definitions, and explicit or implicit (i.e. can be inferred) redundancies amongst existing definitions and axioms. However, “unnecessary definitions can simply be defined as those definitions adding no value to the understanding of the phenomenon under investigation” (Al-debei, 2010, pp.43-46).
4	Quality	Consistency	Inconsistent	Undefined, Constructs, Model, Instantiations	Consistency describes whether valid input data can result in contradictory conclusions: “A definition is consistent if and only if the individual definition is consistent and no contradictory sentences can be inferred from other definitions or axioms.” (Bullinger, 2008, p.213 citing Gómez-Pérez, 2004).
1	Quality	Internal Validity		Model	i.e. [identifying] whereby certain conditions are believed to lead to other conditions, as distinguished spurious relationships (Yin, 2009, Figure 2.3 p.40-45)
1	Beauty	Beautiful		All	Summarizing a 1996 work by noted information systems researcher Fred Brooks, Vaishnavi states that Brooks “proposes an old Greek criterion of wisdom as part of the assessment of a design: Is the tool/artefact true? is it beautiful ? it is good?, which adds an ethical dimension to the assessment process of any design.” (Vaishnavi & Kuechler, 2009)

Table 6-10: Definitions of Evaluation Metrics

6.2.7 Techniques for Capturing Values of the Metrics

6.2.7.1 Overview

In the previous section the literature which describes what needs to be measured to evaluate utility of a designed artefact (the metrics) was reviewed. In this section the literature related to how the researcher can gather valid values of those metrics is reviewed, i.e. what are the techniques that can be used to collect valid values of the metrics.

The same body of 17 sources was consulted to identify valid techniques for capturing values of the metrics (Table 6-4). However, while all 17 sources described metrics, only 10 provided information on techniques to gather values of those metrics. Further, these works provide, with one exception (Yin, 2009), very little few connections between specific metrics and specific techniques.

6.2.7.2 Categories of Evaluation Techniques

Hevner & Chatterjee (2010 pp.112-113) observe that there two broad philosophical groupings (introduced in Table 3-1) of evaluation techniques:

1. Those which take an positivist stance, i.e. there is only one reality, "rational persons can and should agree on the attributes" to be evaluated, and evaluation questions will yield the same result irrespective of who asks them and of whom they are asked (this implies quantitative methods be used).
2. Those which take a subjectivist stance, i.e. that reality is in the eye of the observer, and that "different objective observers of the same phenomenon might legitimately come to different conclusions" and hence "merit and worth must be explored in context" and that "the value of an [artefact] emerges through study […as it is used] in an particular organizational […] environment" (this implies qualitative methods be used).

Hevner et. al. state that "[…] many types of quantitative evaluation of an […] artefact, including optimization proofs, analytical simulation, and quantitative comparisons" are possible as well as context specific evaluations using empirical and qualitative methods. (Hevner et al., 2004, p.77).

Hevner et. al. suggest the following five groupings for all the valid qualitative techniques which can be used in evaluation (Hevner et al., 2004, table 2, p.86):

1. Observational
2. Analytical
3. Experimental
4. Testing
5. Descriptive

6.2.7.3 Advice on Selecting Evaluation Techniques

Within these categories of evaluation techniques the literature suggests that researchers may choose which ever specific techniques they believe are appropriate to capture values of the metrics that they believe appropriately evaluate the utility of the artefact.

For example Hevner et al. advise that evaluation methods should generate evidence to support overall claims of utility. These methods can be drawn from behavioural science (e.g. data collection and empirical analysis techniques) or the formal sciences to support claims of quality and effectiveness (e.g. quantitative analytical techniques) (Hevner et al., 2004, pp.80-81):

> *The selection of evaluation methods [and the associated techniques / tools] must be matched appropriately with the designed artefact, [the problem and its context] and the selected evaluation metrics. [Further] the goodness and efficacy of an artefact can be rigorously demonstrated via well-selected evaluation methods* (Hevner et al., 2004, p.86).

Only in one case does Hevner et. al. go as far as to be specific about which category of techniques may or may not be valid, stating "descriptive methods should only be used for especially innovative artefacts for which other forms of evaluation may not be feasible" (Hevner et al., 2004, p.86).

With few exceptions the literature does not describe which evaluation techniques are applicable to gathering values of metrics for specific research outputs (constructs, models, and instantiations).

Overall none of the works consulted provided specific advice about how a researcher can ensure (or maximize the likelihood) of obtaining valid values for the chosen metrics. For example Osterwalder provides only general arguments and no detailed justification for why a specific evaluation approach was chosen and the general association of technique and metric (Osterwalder, 2004a, pp.127-128).

Finally, there was no advice either in general design science research design articles, such as Hevner et. al, nor in examples of design research projects, about how to handle common issues of research design such as ensuring sufficient levels triangulation or sample diversity.

Advice on these topics was only found in general (case study) research design sources, specifically Yin. For example Yin states that the methods chosen for data collection exhibit certain common features in order to ensure appropriate evidence for the values of specific metrics (Yin, 2009, pp.114-123), as shown in Table 6-11.

Desirable Characteristic of Evaluation Techniques Chosen	Validity of Metric Improved
Multiple sources of evidence	Construct validity
Formal assembly of evidence	Reliability
Chain of Evidence	Reliability

Table 6-11: Characteristics of Evaluation Techniques and Metric Validity

6.2.7.4 Review of Evaluation Techniques

Table 6-12 summarizes the techniques described in the literature reviewed.

Stance (From Hevner & Chatterjee, 2010b, pp.112-113)	**Technique Grouping** (From Hevner et al., 2004, Table 2 p.86)	**Source**	**Technique**	**Metric**	**Research Output Element**	**Application**	**Citation**	**Notes**
Subjective	Analytical	Soft Systems Methdology (SSM)	CATWOE	Unclear - various aspects of Utility, specifically completeness and compliance with real-world phenomena	Constructs	Build	(Jackson, 2000)	SSM Step 3 - root definitions and Step 4 – models. See section 2.9.3.
Subjective	Analytical	Soft Systems Methdology (SSM)	CATWOE	Unclear - various aspects of Utility, specifically completeness and compliance with real-world phenomena	Constructs, Models, Example Instantiations [9]	Evaluate	(Jackson, 2000)	SSM Step 5 comparison
Subjective	Analytical	Soft Systems Methdology (SSM)	CATWOE	Unclear - various aspects of Utility, specifically completeness and compliance with real-world phenomena	Specific Instantiations [10]	Evaluate	(Jackson, 2000)	SSM between steps 7 and 1 and next iteration starts
Subjective	Unclear	System Dynamics (SD)	Unclear	Unclear - various aspects of Utility	Unclear, presumed all	Evaluate	(Assimakopoulos & Riggas, 2006)	Details of techniques not identified
Subjective	Unclear	Problem Structuring Method (PSM)	Unclear	Unclear - various aspects of Utility	Unclear, presumed all	Evaluate	(Assimakopoulos & Riggas, 2006)	Details of techniques not identified

[9] Example Instantiations are ones which the researcher is familiar with from available information sources, but where experts (users) in the example are not available to be consulted

[10] Specific Instantiations are ones which the researcher becomes familiar through direct interaction with experts (users) in a specific situation as well as documentation sources.

Stance (From Hevner & Chatterjee, 2010b, pp.112-113)	**Technique Grouping** (From Hevner et al., 2004, Table 2 p.86)	**Source**	**Technique**	**Metric**	**Research Output Element**	**Application**	**Citation**	**Notes**
Subjective	Unclear	Strategic Surfacing and Testing (SAST)	Unclear	Unclear - various aspects of Utility	Unclear, presumed all	Evaluate	(Assimakopoulos & Riggas, 2006)	Details of techniques not identified
Subjective	Unclear	Systems Thinking (ST)	Unclear	Unclear - various aspects of Utility	Unclear, presumed all	Evaluate	(Assimakopoulos & Riggas, 2006)	Details of techniques not identified
Subjective	Descriptive and/or Observational	Soft Systems Methdology (SSM)	Informal Discussion	Unclear - various aspects of Utility	Unclear, presumed all	Evaluate	(Ledington & Ledington, 1999, p.332)	SSM Step 5 comparison
Subjective	Descriptive and/or Observational	Soft Systems Methdology (SSM)	Formal Questioning	Unclear - various aspects of Utility	Unclear, presumed all	Evaluate	(Ledington & Ledington, 1999, p.332)	SSM Step 5 comparison
Subjective	Descriptive and/or Observational	Soft Systems Methdology (SSM)	Scenario Writing	Unclear - various aspects of Utility	Instantiations	Evaluate	(Ledington & Ledington, 1999, p.332)	SSM Step 5 comparison
Subjective	Descriptive and/or Observational	Soft Systems Methdology (SSM)	Example instantiations of the model	Unclear - various aspects of Utility	Instantiations	Evaluate	(Ledington & Ledington, 1999, p.332)	SSM Step 5 comparison
Subjective	Analytical	Soft Systems Methdology (SSM)	Expectation / Desirability Matrix	Context (Expectations, Desirability, Importance)	Unclear, presumed all	Build	(Ledington & Ledington, 1999, p.336)	SSM Step 3 - root definitions and Step 4 – models. See section 2.9.3
Subjective	Analytical	Soft Systems Methdology (SSM)	Expectation / Desirability Matrix	Context (Expectations, Desirability, Importance)	Unclear, presumed all	Evaluate	(Ledington & Ledington, 1999, p.336)	SSM Step 3 - root definitions and Step 4 – models.

Stance (From Hevner & Chatterjee, 2010b, pp.112-113)	**Technique Grouping** (From Hevner et al., 2004, Table 2 p.86)	**Source**	**Technique**	**Metric**	**Research Output Element**	**Application**	**Citation**	**Notes**
Subjective	Descriptive and/or Observational	Ontology Engineering	Golden Standard/ Data Driven/ Assessment by Humans	Utility (specifically aspects of Completeness, Quality)	Constructs, Models	Prepare, Build, Evaluate	(Brank et al., 2005)	Details of techniques not identified
Subjective	Descriptive and/or Observational	Ontology Engineering	Application based/ Assessment by Humans	Utility (specifically aspects of Completeness, Quality)	Constructs, Models, Instantiations	Evaluate	(Brank et al., 2005)	Details of techniques not identified
Subjective	Observational and/or Analytical and/or Experimental and/or Testing and/or Descriptive	Ontology Engineering	Assessment by Humans	Utility (specifically aspects of Completeness, Quality and Beauty)	Constructs, Models, Instantiations	Evaluate	(Brank et al., 2005)	Details of techniques not identified
Subjective	Observational and/or Analytical and/or Experimental and/or Testing and/or Descriptive	MIS; Innovation	Direct Case Study	Unclear - various aspects of Utility	All, focus on Specific Instantiations	Evaluate	(Bullinger, 2008, p.247, Table 70 p.249, Table 71 p.250; Hevner et al., 2004, Table 2 p.86; Osterwalder, 2004a, pp.149-156)	Osterwalder provides some details on his application of this technique

Stance (From Hevner & Chatterjee, 2010b, pp.112-113)	**Technique Grouping** (From Hevner et al., 2004, Table 2 p.86)	**Source**	**Technique**	**Metric**	**Research Output Element**	**Application**	**Citation**	**Notes**
Subjective	Observational and/or Analytical and/or Experimental and/or Testing and/or Descriptive	MIS	Indirect Case Study	Unclear - various aspects of Utility	All, focus on Example Instantiations	Evaluate	(Osterwalder, 2004a, p.128, pp.139-141)	Osterwalder provides some details on his application of this technique
Subjective	Observational and/or Analytical and/or Experimental and/or Testing and/or Descriptive	MIS; Innovation	Field Study	Unclear - various aspects of Utility	Unclear, presumed all	Evaluate	(Bullinger, 2008, p.247, Table 70 p.249, Table 71 p.250; Hevner et al., 2004, Table 2 p.86)	Details of techniques not identified
Subjective	Analytical	MIS; Innovation	Static Analysis	Unclear - various aspects of Utility, specifically Complexity	Unclear, presumed all	Evaluate	(Bullinger, 2008, p.212, p.247,Table 70 p.249, Table 71 p.250; Hevner et al., 2004, Table 2 p.86; Osterwalder, 2004a, p.128, pp.156-158)	Osterwalder provides some details on his application of this technique
Subjective	Analytical	MIS; Innovation	Architecture Analysis	Unclear - various aspects of Utility, specifically Fit to Organization	Unclear, presumed all	Evaluate	(Bullinger, 2008, p.247, Table 70 p.249, Table 71 p.250; Hevner et al., 2004, Table 2 p.86)	Details of techniques not identified

Stance (From Hevner & Chatterjee, 2010b, pp.112-113)	**Technique Grouping** (From Hevner et al., 2004, Table 2 p.86)	**Source**	**Technique**	**Metric**	**Research Output Element**	**Application**	**Citation**	**Notes**
Subjective	Analytical	MIS; Innovation	Optimization	Unclear - various aspects of Utility	Unclear, presumed all	Evaluate	(Bullinger, 2008, p.247, Table 70 p.249, Table 71 p.250; Hevner et al., 2004, Table 2 p.86)	Details of techniques not identified
Subjective	Analytical	MIS; Innovation	Dynamic Analysis	Unclear - various aspects of Utility, specifically Performance	Unclear, presumed all	Evaluate	(Bullinger, 2008, p.247, Table 70 p.249, Table 71 p.250; Hevner et al., 2004, Table 2 p.86)	Details of techniques not identified
Subjective	Experimental	MIS; Innovation	Controlled Experiment	Unclear - various aspects of Utility, specifically usability	Unclear, presumed all	Evaluate	(Bullinger, 2008, p.247, Table 70 p.249, Table 71 p.250; Hevner et al., 2004, Table 2 p.86)	Details of techniques not identified
Subjective	Experimental	MIS; Innovation	Simulation	Unclear - various aspects of Utility, specifically usability	Unclear, presumed all	Evaluate	(Bullinger, 2008, p.247, Table 70 p.249, Table 71 p.250; Hevner et al., 2004, Table 2 p.86)	Details of techniques not identified
Subjective	Testing	MIS; Innovation	Functional (Black Box) Testing	Unclear - various aspects of Utility	Unclear, presumed all	Evaluate	(Bullinger, 2008, p.247, Table 70 p.249, Table 71 p.250; Hevner et al., 2004, Table 2 p.86; Osterwalder, 2004a)	Details of techniques not identified

Stance (From Hevner & Chatterjee, 2010b, pp.112-113)	**Technique Grouping** (From Hevner et al., 2004, Table 2 p.86)	**Source**	**Technique**	**Metric**	**Research Output Element**	**Application**	**Citation**	**Notes**
Subjective	Testing	MIS; Innovation	Structural (White Box) Testing	Unclear - various aspects of Utility, specifically completeness	Unclear, presumed all	Evaluate	(Bullinger, 2008, p.247, Table 70 p.249, Table 71 p.250; Hevner et al., 2004, Table 2 p.86; Osterwalder, 2004a)	Details of techniques not identified
Subjective	Descriptive	MIS; Innovation; Strategy	Informed Argument	Unclear - various aspects of Utility	Unclear, presumed all	Prepare, Evaluate	(Al-debei, 2010, p.21; Bullinger, 2008, p.247, Table 70 p.249, Table 71 p.250; Hevner et al., 2004, Table 2 p.86; Osterwalder, 2004a)	Details of techniques not identified
Subjective	Descriptive	MIS; Innovation	Scenario	Unclear - various aspects of Utility, specifically fidelity with real-world phenomena	Unclear, presumed all	Evaluate	(Bullinger, 2008, p.247, p.212, Table 70 p.249, Table 71 p.250; Hevner et al., 2004, Table 2 p.86; March & Smith, 1995; Osterwalder, 2004a)	Details of techniques not identified
Subjective	Descriptive	MIS	Interest by Community (Research, Practitioners)	Unclear - various aspects of Utility	Unclear, presumed all	Evaluate	(Osterwalder, 2004a, p.128)	Osterwalder provides some details on his application of this technique

Stance (From Hevner & Chatterjee, 2010b, pp.112-113)	**Technique Grouping** (From Hevner et al., 2004, Table 2 p.86)	**Source**	**Technique**	**Metric**	**Research Output Element**	**Application**	**Citation**	**Notes**
Subjective	Descriptive and/or Observational	MIS	Semi-structured Interviews	Unclear - various aspects of Utility, specifically appropriateness	Unclear, presumed all	Evaluate	(Osterwalder, 2004a, p.128, pp.131-132)	Osterwalder provides some details on his application of this technique
Subjective	Analytical	Cast Study Research Design	Static Analysis	Unclear - various aspects of Utility	Unclear, presumed all	Prepare, Build, Evaluate	(Yin, 2009, p.98)	Description of types of evidence that can be gathered - "docments, archival records,"
Subjective	Observational	Cast Study Research Design	Static Analysis	Unclear - various aspects of Utility	Unclear, presumed all	Evaluate	(Yin, 2009, p.98)	Description of methods by which evidence that can be gathered "interviews, direct observation, participant observation)
Objective	Unclear	MIS	Unclear	Unclear - various aspects of Utility	All	Evaluate	(Hevner & Chatterjee, 2010b, p.77, pp.112-113)	Details of techniques not identified

Table 6-12: Summary of Evaluation Techniques

6.2.7.5 Notes on Specific Techniques from Sources

Assimakopoulous and Riggas construct a research approach which uses a variety of techniques, including alternatives to CATWOE. However, they are not clear on the metrics these techniques are measuring, except in general terms. The overall research approach is described as being an integration of techniques from Systems Dynamics modelling (SD), Problem Structuring Method (PSM), Strategic Assumption Surfacing and Testing (SAST) and Systems Thinking (ST) (Assimakopoulos & Riggas, 2006).

Ledington and Ledington summarize the soft systems methodology literature on the techniques (methods) to undertake the comparison activities in an SSM project (stage 5):

> *The literature is very consistent about methods for carrying out the comparison activity. Four approaches to doing the comparison are suggested in the form of informal discussion; formal questioning; scenario writing based on 'operating' the models; and trying to model the real world in the same structure as the conceptual models. Two main techniques are illustrated to support comparison in the form of an activity matrix and a model overlay approach* (Ledington & Ledington, 1999, p.332).

However they note the literature is far from providing clear detailed guidance to research designers on how to apply these techniques, noting:

> *[There are] very few examples of the comparison activity [] given and there is no in-depth discussion of the examples that are to be found. There is no guidance as to when to use one approach in preference to another, and the strengths and weaknesses of the approaches are nowhere to be found. [… There are] no clear statement[s] of what questions are to be addressed or what basis is to be used for selecting the questions. The only agreement across the literature seems to be that the questions initially focus upon whether the activities in this model actually exist in the situation or not. Further, the literature provides little help with interpreting the information structured in the completed matrix* (Ledington & Ledington, 1999, p.332).

As introduced in (3.5.4.2 Surfacing Designer and User Context), these authors then proposed that the reliability of evaluation can be enhanced through the development of an expectation /

desirability matrix, as shown in Table 6-13. They recommend this matrix be developed during the build activities and then applied to support the "interpretation of the comparison results" (Ledington & Ledington, 1999, p.336). As described earlier, the intention is to surface the designers and users context (biases) for the evaluation, thereby increasing the value of the evaluation process.

These authors recommend that during the build phase (or at least prior to the evaluation phase) the following matrix is completed, and the actions indicated undertaken, i.e. the designed artefact ought to contain alternatives which fit all four positions in the matrix. As a second possibility, designers and users may use the matrix to recognize where the artefact is positioned prior to evaluation commencing.

		Desirability	
		Desirable	**Undesirable**
Expectation	**High**	Situation ought to be like the model and the model is desirable in the context of the problem. Identify weaknesses of situation in relation to the model. Develop ways of improving operation of activities	Situation expected to be like the model but is undesirable. Initiate action to remove (or constrain) operational aspects of situation that are like the model.
	Low	Situation is not like the model but model is desirable. Initiate strategic action to consider, decide, design, develop and implement appropriate purposeful action in situation.	Situation is not like the model and the model is undesirable. Strategic action to identify any threats that unwanted activity might develop and develop preventative measures.

Table 6-13: Expectation / Desirability Matrix
(Ledington & Ledington, 1999, p.336)

Brank et. al., coming from an artificial intelligence ontological engineering perspective, provide, in their 2005 review of ontology evaluation, the techniques to document the correspondence between the evaluation metrics (which they refer to as "levels") and techniques (which they refer to as "approaches"). This is shown in Table 6-14.

This work assumes that the first three of the four approaches to evaluation would be automated, normal in the artificial intelligence context. However, it is clear that the forth approach to evaluation, a generic "assessment by humans", could be based on the principles embodied in the first three approaches. After all humans can usually also perform the tasks that are automated, albeit at a different speed and reliability.

	Techniques for Evaluation			
Level of Evaluation Metric	**Golden Standard**	**Application-Based**	**Data-Driven**	**Assessment by Humans**
Lexical, vocabulary, concept, data	x	x	x	x
Hierarchy, taxonomy	x	x	x	x
Other semantic relations	x	x	x	x
Context, Application		x		x
Syntactic	x			x
Structure, architecture. Design				x

Table 6-14: Summary of Artificial Intelligence Ontology Evaluation Techniques / Metrics (by Level)
(Brank et al., 2005)

Brank et. al.'s "Golden Standard" and "Data-Driven" refer to sources of trusted information, that can either be used in the build or evaluation of the ontology. Clearly using the same source in both stages would be unwise.

By "Application Based" these authors envisage that the ontology would be used in a computer program (an application) and the results of this use evaluated. However, as noted above, this can be generalized to the application of the ontology to a real-world problem by humans, and the evaluation of this use.

Finally, and most closely aligned with the techniques from outside the ontology engineering field, “Assessment by Humans” is taken to mean “how well the ontology meets a set of predefined criteria, standards, requirements, etc.”

Moving to the details of evaluation techniques provided by the MIS literature, within the five groupings of evaluation methods Hevner et. al. identify (described above), eleven techniques to gather values for metrics are suggested, shown in Table 6-15. With only one or two expectations, these authors do not identify which metrics’ values are best gathered by which techniques, nor, which techniques apply to which specific research outputs.

Evaluation Technique Grouping	**Description of Specific Techniques**
1. Observational	Case Study: Study artifact in depth in business environment
	Field Study: Monitor use of artifact in multiple projects
2. Analytical	Static Analysis: Examine structure of artifact for static qualities (e.g. complexity)
	Architecture Analysis: Study fit of artifact into technical IS architecture
	Optimization: Demonstrate inherent optimal properties of artifact or provide optimality bounds on artifact behaviour
	Dynamic Analysis: Study artifact in use for dynamic qualities (e.g. performance)
3. Experimental	Controlled Experiment: Study artifact in controlled environment for qualities (e.g. usability)
	Simulation — Execute artifact with artificial data
4. Testing	Functional (Black Box) Testing: Execute artifact interfaces to discover failures and identify defects
	Structural (White Box) Testing. Perform coverage testing of some metric (e.g. execution paths) in the artifact implementation
5. Descriptive	Informed Argument- Use information from the knowledge base (e.g. relevant research) to build a convincing argument for the artifacts utility
	Scenarios: Construct detailed scenarios around the artifact to demonstrate its utility

Table 6-15: Possible Evaluation Technique by Grouping
(Groupings from Hevner et al., 2004, Table 2 p.86. Copyright © 2004, Regents of the University of Minnesota. Used with permission)

Osterwalder provides some details of the evaluation techniques he chose to evaluate his business model ontology. Table 6-16 shows Bullinger's summary of Osterwalder's choices of evaluation techniques aligned with Hevner et. al.'s groupings.

Evaluation Technique Grouping	**Specific Techniques Employed by Osterwalder to Evaluate the BMO**
1. Observational	Case Study
2. Analytical	None
3. Experimental	None
4. Testing	Test in the field
	Test vs. other model in the field
5. Descriptive	Compare with the literature
	Evaluation with practitioners
	Interest by research community.

Table 6-16: Techniques Employed to Evaluate BMO
(From Bullinger, 2008, Table 70 p.249 that was derived from; Hevner et al., 2004,Table 2 p.86 and; Osterwalder, 2004a, Fig.66 p.128)

It is clear that Osterwalder, when selecting and describing the above evaluation techniques:

- Compared in his literature review the constructs in his ontology with the constructs in a number of other business ontologies, albeit rather informally, as input into the construction of his ontology (Osterwalder, 2004a, p.156).
- Undertook two different types of case studies to validate his ontology:
    1. Direct case studies. In one of these Osterwalder showed a manager in a firm their organization's business model described using his ontology and gained general feedback (i.e. there was no specific problem with the business model). In the other example Osterwalder used his ontology to describe a firm's business model, and asked for specific feedback relating to a problem the firm was having: aligning their operational needs with their IT infrastructure and IT application portfolios (pp.149-156).

2. Indirect case studies – i.e. not from managers in the firm being studied: In addition to conducting his own direct case study he got feedback from masters students who used the BMO in course assignments to evaluate 9 companies (p.128, pp.139-141). He also used the BMO in a number of developing economy contexts (p.141).

- Noted that interviews with managers and consultants cannot evaluate a model's performance (which is measured by evaluating instantiations), but it can "give an impression of […] appropriateness to perform the task of describing the business logic of a firm" (his definition of the purpose a business model). Osterwalder states appropriateness can be shown in terms of both the willingness / interest of the interviewees to participate in the research and the feedback from the interviews themselves (Osterwalder, 2004a, p.128)[11].

- Showed his interviewees both his ontology and a number of (partial) instantiations of the BMO (p.132) to gain their feedback to assess fidelity with real-world phenomena. Osterwalder cites March et. al. to suggest the validity of this approach (March & Smith, 1995).

- Observed the research communities interest in the ontology stating that their level of interest "probably means that at least some aspects of [the BMO] constitute a certain advance in the business model domain" (Osterwalder, 2004a, p.128).

- Realized testing the performance of the ontology in the field by instantiating it in a real-world business setting (e.g. visualization and implementation) or comparing an instantiation of his ontology with an instantiation of another ontology and "see how [his ontology] performs" is "very laborious to realize and not covered in this dissertation" (Osterwalder, 2004a, p.128). However, Osterwalder does provide a framework for doing a comparison of instantiations of ontologies (pp.156-158).

[11] Osterwalder conducted 12 60-90 minute semi-structured interviews (Osterwalder, 2004a, p.131).

Bullinger in her innovation / entrepreneurship related ontology, when selecting and describing the evaluation techniques she chooses makes the following points:

- Evaluation should be part of an iterative process of ontology development and should be conducted during every step of ontology development (Bullinger, 2008, p.213).
- Evaluation should be conducted "against a [defined] frame of reference (a set of competency questions, requirements or the real-world" (Bullinger, 2008, p.213).
- Evaluation should be conducted in a range of geographic locations by a range of people (developers, users, others) (Bullinger, 2008, p.213).
- Evaluation should involve the users of the ontology through "the presentation of a prototype […] in order to check whether the developed ontology suffices the ontology requirements" (Bullinger, 2008, p.212).
  - However, while "integration of end users […] to judge the usability and usefulness of an ontology is crucial to the further use of the ontology", as of 2008, this idea had not been formally included in the ontology engineering literature she reviewed (Bullinger, 2008, p.215, p.248).
- The review of the literature of ontology engineering methodologies suggests the following techniques can help determine the usability of an ontology (Bullinger, 2008, p.215):
  - A graphical representation of the top-level concepts and their relations.
  - A "review system for ontologies, similar to the ones of amazon.com", including qualitative assessment and experience reports.
  - Provide users a view of the ontology that "takes into account their expertise, perspectives, the required level of granularity, or a subset of the domain the ontology they're interested in covers" and that these "views should be available according to different user profiles" (expert to novice). This makes evaluation by

users easier since the ontology will be expressed in concepts related to the users' interests, rather than a "large general reference resource".

Based on this review of the evaluation literature, Bullinger then picks a number of techniques from Hevner et. al.'s list (Table 6-15), and aligns these techniques with gathering values for specific metrics and specific research outputs, shown in Table 6-17.

However, she does this based on her sense of "appropriateness", simply noting Osterwalder as precedent for her choices (Bullinger, 2008, p.248, p.249,table 71 p.250). She does not explain the logic of her choices (i.e. she does not formally tie each choice back to the literature).

Evaluation Technique Grouping	Evaluation Metric	Evaluation Technique	Research Output
Experimental[12] Descriptive Analytic	Completeness Simplicity Elegance Comprehensibility Ease of Use	Compare with Literature Static Analysis Evaluation with Practitioners (includes. interviews)	Construct
	Efficiency Generality Ease of Use		Model
Experimental Observational	Fidelity with reality Completeness Level of Detail Robustness Internal Consistency	Case Study (includes interviews and other data gathering)	Instantiation
Not evaluated	Not evaluated	Not evaluated	Method

Table 6-17: Techniques and Metrics Employed to Evaluate Innovation Ontology
(Adapted from Bullinger, 2008, Table 71 p.250)

[12] Table in original does not include this, but text below table states "evaluation of constructs, model and instantiation mainly take place via experimental interviews with ontology consumers during first evaluation. Experimental interviews means that ontology consumers test the ontology and are simultaneously and subsequently interviewed with respect to the validation criteria listed in table 71."

Finally, Yin in his comprehensive discussion of the methods and techniques for conducting case study research suggests there are six sources of evidence that can be gathered to evaluate a case: documents, archival records, interviews, direct observation, and participant observation. Further he notes that each source requires a different combination of data collection methods, each of which have specific strengths and weaknesses (Yin, 2009, p.98, Fig. 4.1 p.102).

More specifically, related to exploratory research, he notes that the case study approach can be used to gather high quality values of three metrics of a design using the techniques shown in Table 6-18.

Metric	Technique and Technique Characteristic to Capture Valid Metric Value
Construct validity	Use multiple sources of evidence
	Establish a chain of evidence
	Have key informants review study outputs
External validity	Use theory in single case studies and replication logic in multiple case studies
Reliability	Use a defined protocol for the study
	Create comprehensive documentation of intermediate and final work products.

Table 6-18: Techniques Employed to Gather Valid Values of Metrics
(Yin, 2009, Fig. 2.3, pp.40-45, pp.114-123)[13]

6.2.8 Contributions to Evaluation during Preparation and Build

In a number of places the design science and soft systems literature suggests that activities that contribute to a rigorous evaluation need to be undertaken during preparation and build activity streams. This literature was reviewed in 4.2.1.5 (Preparation) and 5.2.5.2 (Build).

[13] While these tests were designed toevaluate the quality of a case study research project's approach, in principle they ought to apply to any designed artefact – whether research approach or ontology.

6.3 Choosing the Approach for Evaluation

The review and summary of the literature on evaluation from the design science, ontology engineering, and soft systems methodology fields was presented in the previous section. This included the definition and purpose of evaluation, along with the recommended process for undertaking evaluation, the metrics which can be gathered and the techniques for gathering the values of these metrics.

This section presents a reflection on this literature; the following section presents the results of applying this reflection to make choices to create the evaluation activity stream detailed design.

6.3.1 The Current State of the Art

The literature suggests that understanding how best to evaluate design artefacts is a relatively new field of research. The advice and guidance on how to construct a high quality evaluation research design that leads to a rigorous high quality valid assessment of artefact utility is at best incomplete, and in some cases contradictory.

For evaluation research designers the literature has a troubling lack of specificity in:

1. The definition of metrics of utility
2. Detailed description of methods to gather valid values of specific metrics,
3. The overall assembly of a combination of techniques and metrics to ensure coverage of all aspects of utility.

However, despite these concerns, recently the exemplar researchers have all managed to construct and justify their evaluation research designs. The strong impression one receives is that these researchers have abducted their evaluation research designs from the literature. While not specific, these researchers' approaches is highly suggestive of correspondences between the broad categories of metrics, techniques and applicability.

6.3.2 Evaluation Research Design Goals

6.3.2.1 Introduction

Though the exemplar researchers successfully defended their research designs, there is room for improvement. A possible contribution of this research is to improve research output quality by attempting to be more explicit in the process that creates the evaluation stage of the research, i.e. defining design goals for the research design, the possible choices of research design, the selected choice and the basis for these choices.[14].

Hence, the goal in this section is, based on the literature, to be as explicit as possible about the process by which the evaluation activity stream is designed.

6.3.2.2 Detailed Goals

The literature on the design of the evaluation stage makes it clear that typical risks to research output validity that apply when designing any kind of systemic design science (and indeed qualitative research in general), also apply to the evaluate stage of design science research.

Applying the earlier analysis of these points (3.5.4): it is important to identify research design goals to mitigate these risks. Specifically it is a goal of this evaluation research design that there be:

- Explicit setting of boundaries for the evaluation (3.5.4.4)
- Explicit consideration of world-views (3.5.4.5) through diversity in sources of feedback on the SSBMO, i.e. number and nature of data sources and nature of sampling approach.
- Triangulation of feedback on the SSBMO (3.5.4.6), i.e. evidence from multiple sources to provide validity for each metric's measured value.

[14] i.e. the search, reflect, apply steps set out at the start of this part.

With these goals in mind, to achieve a diversity of reliable comparator knowledge, it is important for the evaluation research design to consider:

- The nature of organizations that provide feedback individually and collectively, i.e. questions of industry, size, location, etc.
- The credibility, reliability and world-views' of the persons who provide feedback, i.e. managerial seniority (e.g. knowledge of business strategy and business models), and perspective on the purpose and nature of business (e.g. profit first to integrating achievement of economic, social and environmental goals).
- The diversity and provenance of any documentary sources of comparator knowledge against which the SSBMO is evaluated to generate feedback, i.e. a similar diversity of world view of the authors of these sources is required as for the persons who provide feedback.
- Traceability of evidence to support evaluation conclusions from feedback sources to either change in the design of the SSBMO or identification of inherent capabilities and limitations in the SSBMO design.
- The steps required to overcome sources of evaluation biases in the mechanics of each feedback collection technique (i.e. basis inherent gathering of valid values of the metrics).

6.3.3 Constraints on the Choices of Evaluation Research Design

There are always practical constraints when making the choices between possible evaluation research designs. As part of being explicit about the research design process for this research, for evaluation these constraints are:

1. Time to research metrics and methods
2. Time and skill to conduct evaluation techniques
3. Availability of quantitative time series data within research project timelines
4. Effort available within available time
5. Access to comparator data sources (documents, people)

Clearly any constraints will have an impact on the rigorousness and quality of the validity assessments of the utility of the SSBMO. However, within the scope of an exploratory thesis, which is not claiming a high degree of generalizability, and in comparison with examples from the exemplar literature, these compromises are not problematic. They simply open avenues for further research (Chapter 11).

6.3.4 Process for Creating Evaluation Research Design

The literature on the design of the evaluation stage also underlines the importance of aligning both the processes used to evaluate and the evaluation of artefact validity with the research problem statement. However, the literature does not describe the process by which this can be achieved.

Therefore, to produce the evaluation research design and to meet the overall and detailed goals stated above, while minimizing the impact of the identified constraints, a process to design my evaluation research design is formally described and applied below: this is suggested to be a novel approach to the design of a design science evaluation activity.

This process was synthesized and abducted from the literature reviewed in 6.2 and described below. The output or results from using this process is documented in the next sections (6.4-6.8).

The evaluation research design process uses the following nine steps, each executed in relation to the research objective (Chapter 2, 3.6):

1. Choose and justify a framework for the design of the evaluation stage of this research.
2. Identify and justify evaluation unit of analysis.
3. Identify the designer and user context for the evaluation process.
4. Identify the research outputs to be evaluated.
5. Identify and justify the nature and validity of the sources of knowledge which will be compared to the SSBMO.

6. Define and justify the metrics of design validity.
7. Identifying and justifying specific techniques for collecting valid values of these metrics, including identifying which techniques collect valid values for which research outputs.
8. Choose and justify overall evaluation process which describes the grouping and sequence in which the evaluation work will be conducted by synthesizing the outputs from executing the previous seven steps (1 thru 7).
9. Identifying potential challenges to the quality of the evaluation (risks) and the association mitigation techniques used to increase the likelihood of collecting valid values of the metrics.

6.4 Evaluation Detailed Research Design – Overview

This section applies the reflection of the literature searched above. It presents an overview of the research design created to undertake the evaluation of the SSBMO using a variety of comparator knowledge sources, metrics and techniques. The use of the SSBMC within the evaluation process is described.

The detailed research design for evaluation developed from the overall design principles (Chapter 3 and 4), given the overall research objectives (Chapter 2 and 3.6.6) and the evaluation research design goals (6.3.2) is presented.

6.4.1 Introduction

This section documents the output from the application of the first seven of the nine steps of the process described above (6.3.4) used to create the SSBMO evaluation research design (sections 6.4.2 thru 6.4.8).

Then in the eighth step, the outputs from these first seven steps, were synthesized into four groupings of evaluation research activities which will be executed to undertake the evaluation stage (section 6.4.9). These activity groups are:

E1. Comparative Analysis

E2. 3rd Party Review

E3. Case Study

E4. Feedback Synthesis & Analysis

Then a description of the risk mitigation techniques to be included in the research design (the ninth step 6.4.10).

A summary of the research outputs, metrics, activities, techniques and sources of knowledge against which the SSBMO will be evaluated is provided at the end of this Part (Table II-3).

Sections 6.5 thru 6.8 then introduce and describe the details of each of the four groupings of evaluation research activities.

6.4.2 Evaluation Research Design Framework

The evaluation design framework has been chosen based on the advice and framework provided by Cleven et. al (see Table 6-2, 6.2.4.2 "The Design Science and Ontology Engineering Perspectives). This is shown in Table 6-19.

Variable	Possible Values[15]	Chosen Approach for Identifying Values for Evaluating SSBMO
Ontology[16]	Essentialist…Anti-foundationalist	Critical pragmatism[17]
Epistemology[18]	Positivism…Anti-Positivist	
Research Purpose	Exploration, Explanation, Description, Prediction	Exploration
Approach	Qualitative…Quantitative	Qualitative[19]
Object	Artefact and/or Artefact Construction Process	Artefact[20]
Artefact Focus	Technical…Organizational… Strategic	Organizational…Strategic[21]
Time	Ex-ante…Ex-post	Combination[22]
Reference Point[23]	a. Artefact against Research Gap, b. Artefact against "Real World", c. Research gap against "Real World" d. Research Gap against Artefact e. "Real-World" against instantiation of artefact	For ex-ante d. Research gap against Artefact. For ex-post a combination of d. and e. Details of choices made for evaluation of SSBMO in this section and sections 6.5 thru 6.7
Position	Internally (researcher only)… Externally (others only)	For ex-ante internally only. For ex-post varies – details of choices made for evaluation of SSBMO in this section and sections 6.5 thru 6.7
Artefact Type	Construct, Model, Instantiation, Method, Theory	Construct, Model, and Instantiation – details of choices made for evaluation of SSBMO in this section and sections 6.5 thru 6.7

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15 In the following table the possible values are presented as
- Book-ends, and/or multiple points on continuums (shown as ellipses '…' between possible values) or
- Discrete choices (shown as commas between possible values)

16 This is the philosophical / metaphysical use – "nature, its essential properties, relations of being and the organization of reality" (Bullinger, 2008, p.138), see Table 3-1.

17 See 3.2.3

18 See Table 3-1

19 This choice is driven by available time, effort, ability to gather quantitative data (static and time series) within the research project timelines, and researcher knowledge.

20 While constraints of both time and effort would suggest focusing on only the evaluation of the artefact, from the literature review for both the Build and Evaluation stages it appears I may have both a artefact and methodological contribution. However, there will be no formal evaluation of the methodological contribution. However, when apparent gaps in research rigour will be recorded (6.8))

21 From an information systems perspective there is no technical aspect of the SSBMO, however, the SSBMO is intended to assist with organization redesign and strategic roadmap development and operationalization.

22 Some evaluation will be conducted ex-ante during initial iterations of the preparation (discussed in 4.2.1.5) and build activity streams (discussed in 5.2.5.2), but the majority will be conducted ex-post during later iterations of the build and evaluate activity streams – details in this section.

23 "Research gap" includes both the definition of the problem the designed artefact is intended to improve and body of knowledge being applied in the novel design. The latter two possibilities are suggested from the systems perspective taken by Ledington and Ledington's metric "Organizational Fit to Artefact" (Table 6-8), defined in "High / Low Expectation of Likeness" (Table 6-10).

Variable	Possible Values[15]	Chosen Approach for Identifying Values for Evaluating SSBMO
Function (purpose of metric)	Knowledge…Control… Development…Legitimization	Evaluation to fulfill all functions[24] – See 6.2.6 for review of relevant literature, this section and sections 6.5thru 6.7 for details of choices made for evaluation of SSBMO
Perspective (type of metric)	Economic… Deployment… Engineering… Epistemological	Varies – See 6.2.6 for review of relevant literature, this section and sections 6.5 thru 6.7 for details of choices made for evaluation of SSBMO
Method / Technique	examples: Action Research, Case Study, Field Experiment, Formal Proof, Controlled Experiment, Prototype, Survey	Multiple: For ex-ante see 4.2.1.5 and 5.2.5.2. For ex-post see 6.2.7, this section and sections 6.5 thru 6.7 for details of choices made for evaluation of SSBMO

Table 6-19: SSBMO Evaluation Design Framework
(Adapted from Cleven et al., 2009, table 1)

6.4.3 Unit of Analysis

From the overall perspective the unit of analysis for evaluation is the whole SSBMO – i.e. an ontology that can be used to describe any business model. As a design science research output the SSBMO artefact consists of constructs and a model, each of which could be said to be "sub-units" of analysis in the evaluation.

However, when evaluating instantiations of the SSBMO, i.e. business models described using the SSBMO, the unit of analysis changes to the scope of the business model being described. In this regard one of the contributions of Stähler's PhD (2002a) was to legitimize the business model as a unit of analysis along side traditional management science units of analysis such as business unit, industry, the firm / corporation (Stähler, 2002b).

6.4.4 Evaluation Process Context

As advised by Ledington & Ledington, this researcher recognizes, as the designer of the SSBMO, the context which this brings to the evaluation activities (see 6.2.7.4 "Notes on

[24] Specifically legitimization is a combination of ex-ante techniques employed during initial iterations of prepare and build, and ex-post techniques employed during later iterations of build and evaluate.

Specific Techniques from Sources”). The context for the evaluation of this research is recorded in Table 6-20.

Based on these authors’ advice, explicitly considering this context, when interpreting values of the metrics using the chosen techniques, should result in increased reliability of the evaluation.

This context will also most likely apply to the persons being consulted to help with the evaluation. This will be informally confirmed based on observations of these experts’ approach and attitudes to providing their feedback on the SSBMO.

		Desirability	
		Desirable	**Undesirable**
Expectation	**High**	The purpose of the SSBMO is expected and desired to allow business model designers to see a firm’s business model within the constructs and model of the SSBMO. In turn this is expected and desired to improve the efficiency (reliability, consistency, effectiveness) of these business model descriptions and improve the efficiency of the business model designers who create them.	There are no elements of the SSBMO that are expected to be undesirable. However, each metric is part of a dyad to ensure both positive and any negative (undesirable) aspects are explicitly discovered during evaluation (see 6.4.7)
	Low	The are no elements of the SSBMO that are not expected to be desirable. However, a number of the metrics selected are explicitly designed to discover elements of the SSBMO that are unexpected (see 6.4.7).	There are no elements of the SSBMO that are not expected to be undesirable. Through triangulation of the metrics in the top right and bottom left quadrants any aspects of the SSBMO that fit this category should be uncovered.

Table 6-20: SSBMO Expectation / Desirability Matrix
(Based on Ledington & Ledington, 1999, p.336)

Note: in effect Table 6-20 records the values of metrics M1, M2 and M3 (identified in Table 6-22 and defined in Table 6-23 below). This provides the context for all the values of all the other metrics to be gathered and their subsequent analysis (Chapters 8 and 9).

6.4.5 Research Outputs to Be Evaluated

The following research outputs, which together comprise the SSBMO, are to be evaluated individually and together as a whole:

1. The constructs captured and coded within the SSBMO
2. The model, i.e. the relationships between the constructs and the context for an organization captured and coded within the SSBMO.
3. Instantiations of the SSBMO, i.e. business models described using the SSBMO and its visual simplification, the SSBMC.

6.4.6 Sources and Validity of Comparator Knowledge

6.4.6.1 Introduction

The literature on evaluation highlights the importance to evaluation quality of the selection of appropriately valid sources of knowledge to compare to the artefact being evaluated, i.e comparator knowledge. The process of selecting these sources includes questions of sampling, when selecting, for example, cases and interviewees. But it also includes the selection of "golden standards" and data sources for "data-driven" evaluation techniques (See Table 6-14, 6.2.7 and specifically Brank et al., 2005).

In other words, before selecting specific sources (written or human), the knowledge context for the evaluation of the SSBMO and hence what knowledge might be valid to evaluate the ontology must be understood.

The knowledge context for the evaluation is the knowledge used during the build of the ontology, i.e. the key theoretical frames (K0, Chapters 3 & 4). The knowledge context in turn is based on the business problem the ontology is looking to solve (Chapter 2).

Without understanding the knowledge context one might pick comparator sources of knowledge that overlap with the key theoretical frames. This would then mean that the evaluation was determining how well the SSBMO captured the key theoretical frames rather than its utility.

6.4.6.2 Implications of Nature of Sources of Knowledge for the Evaluation of Ontologies

As per second Overall Design Principle (ODP2), the intention to incorporate in the constructs and model of the SSBMO both the profit first (K0-PF) and strongly sustainable (K0-SS) prescriptive world-views, requires that to effectively evaluate the SSBMO different sources of valid knowledge of business models based on these same two world-views must be used.

For example, if comparator sources of knowledge (written and human) that only presume the profit-first world-view are used to evaluate the SSBMO, the ability of the SSBMO to describe strongly sustainable business models will not be evaluated, and vice versa.

This need to obtain valid sources of knowledge that are premised on one or other of these two world-views drives a number of aspects of the evaluation research design, described in the following sections.

All this aligned well with advice on selecting the cases (the comparator knowledge sources) provided by Yin (2009) and Tellis (1997, p.4). These authors suggest that for exploratory case studies, the case(s) should be selected so as to "offer the opportunity to maximize what can be learned, knowing that time is limited."

Thus comparator knowledge sources (either cases or 3rd party experts) that explicitly represent either the strongly-sustainable or profit-first world view might be described as a "critical" or possibly "extreme" cases (2009, pp.47-48).

Specifically, the idea is to select:

- 3rd party experts to review that have differing world-views to offer confirming and disconfirming observations.

- Cases of firms that have varying levels of stated commitment to improving their sustainability: from proactively committed to being / becoming strong sustainability, to ‘simple’ commitment to maximizing monetary profitability.

In addition to assessing the utility of the SSBMO given a variety of user world-views, this approach also creates potential for learnings from cross 3rd party expert and case comparisons.

6.4.6.3 Types of Knowledge for the Evaluation of the SSBMO

The three research outputs need two different types of knowledge to evaluate them, based on the nature of the outputs:

Firstly: The evaluation of constructs and the model require knowledge that can support or refute the definitions created for them in the build activities. This knowledge can come from authoritative sources who have conducted research in the applicable key theoretical frameworks from which the constructs and model have been defined, just not the same sources already used in the prepare and build activities. This knowledge can also come directly from knowledge of business models of actual operating firms.

Secondly: To evaluate the ability of SSBMO to describe business models, knowledge sources containing instantiations of the SSBMO must first be prepared (i.e. descriptions of actual business models). The preparation of these knowledge sources is one of the activities to be carried out in evaluation. To do so earlier, during prepare or build, would introduce the potential for bias into the evaluation. To construct instantiations of the SSBMO requires knowledge of business models (patterns, samples, or actual operating firms).

6.4.6.4 Sources of Comparator Knowledge for the Evaluation of the SSBMO (K1 thru K6)

Within these constraints six sources of comparator knowledge have been identified, labelled K1-6, introduced below. Table 6-21 introduces these six sources of comparator knowledge to be used in the evaluation of the SSBMO.

Research Output	Comparator Knowledge Source	Independence of Knowledge Used to Build SSBMO	World View of Knowledge Source	Justification of Validity
Constructs, Model, Instantiations	K1. CATWOE framework – both knowledge about problems and solutions and a technique for application of this knowledge to test completeness / ensure rigour in understanding of problem and designed solution (Jackson, 2000, p.254), See 6.5 for details.	Yes	Systems approaches to problem solving increase utility of designed solutions	The SSM community of researchers and practitioners has developed and refined the knowledge and application of the CATWOE framework over the past 40 years. This framework is believed to be a reasonable test, from multiple world-views of the rigorousness and completeness of the definition of constructs (SSM root definitions) and models.
Constructs, Model	K2. B Lab Impact Assessment version 3 obtained from personal communication with head of certifications at B Lab, See section 6 for details. The B Lab Impact Assessment version 3 is a comprehensive assessment of a firm's "strongly sustainable" orientation, focused on social and environmental performance	Yes	Strongly sustainable (K0-SS)	The B Lab Impact Assessment Survey is now in version 3 following extensive development, use and feedback over the past 4 years it has been used to assess the environmental and social performance of over 488 certified B-Corporations (Benefit Corps) and numerous others. The original development has been an open process "involving over 600 entrepreneurs, investors, thought leaders and academics". The items which form Impact Assessment Survey are now also used for the Impact Rating and Investment System (IRIS) which is governed by an independent nine person Standards Advisory Council. (B Lab, 2010b; B Lab, 2010b; GIIN, 2010a; GIIN, 2010b)

Research Output	Comparator Knowledge Source	Independence of Knowledge Used to Build SSBMO	World View of Knowledge Source	Justification of Validity
Instantiation	K3. Publically available sources of knowledge of The Timberland Company (annual and quarterly financial, environmental and social reports retrieved from website) See 6.5.4 for details. This knowledge will be used to create a description of The Timberland Company's business model using the SSBMO & SSBMC (K3-BM). The process of using the SSBMO to create the description of The Timberland Company business model is part of the evaluation	Yes	Profit first (K0-PF) but with some elements of strongly sustainable (K0-SS).	Timberland has been acknowledged as an environmental and social leader over the past years. In a recent assignment, using the B Lab Impact Assessment Survey v2 and the same publically available information The Timberland Company scored 78.4 / 200; the lowest score for a certified B Corp is 80 / 200 (Drapeau, Jain, Kist, Lo, & Upward, 2010)
Constructs, Model	K4. Knowledge of 3rd Party experts with a range of knowledge and experience of the constructs within and the relationships in business models based on a range of world-views from "profit-first" to "strongly-sustainable"	Yes	Range of world-views from profit first (K0-PF) to strongly sustainable (K0-SS).	This collection of practitioners and academics are carefully selected to have a diverse set of world-views based on their training, experience and knowledge of the purpose and content of business models. See 6.6 for details

Research Output	Comparator Knowledge Source	Independence of Knowledge Used to Build SSBMO	World View of Knowledge Source	Justification of Validity
Models, Instantiations	K5. Knowledge in the heads of 3rd party experts with a range of knowledge about operating organizations whose business models are based on a range of world-views from "profit-first" to "strongly-sustainable"	Yes	Range of world-views from profit first (K0-PF) to strongly sustainable (K0-SS).	This collection of practitioners and academics are carefully selected to have broad experience and knowledge of a range of operating organization's business models – which are in turn based on a range of world-views of the stakeholders of those organizations. See 6.7 for details
Instantiations	K6. Knowledge in the heads of Employee (K6-E#) of and other data sources (K6-D#) about selected case study firms, whose existing business models are based on world-views which range from "strongly-sustainable" to "profit-first". This knowledge will be used to create a description of the case firm's business model using the SSBMO & SSBMC (K6-BM#). The process of using the SSBMO to create these business models is part of the evaluation.	Yes	Range of world-views from profit first (K0-PF) to strongly sustainable (K0-SS).	The set of case firms are carefully selected to ensure that a range of their stakeholder's world-views from "strongly-sustainable" to "profit-first" and hence business models were included. See 6.7 for details.

Table 6-21: Sources of Comparator Knowledge for the Evaluation of the SSBMO

6.4.6.5 Summary Source of Knowledge for the Build and Evaluation of the SSBMO (K0-K6)

Figure 6-4 shows the sources of knowledge used in the build (K0, K0-SS, K0-PF, and the sources of comparator knowledge (K1-6) to be used in the evaluation of the SSBMO.

In some cases the comparator knowledge sources will be used directly in the evaluation process, in other cases it will be used to create an instantiation of the SSBMO which will then be used in the evaluation process.

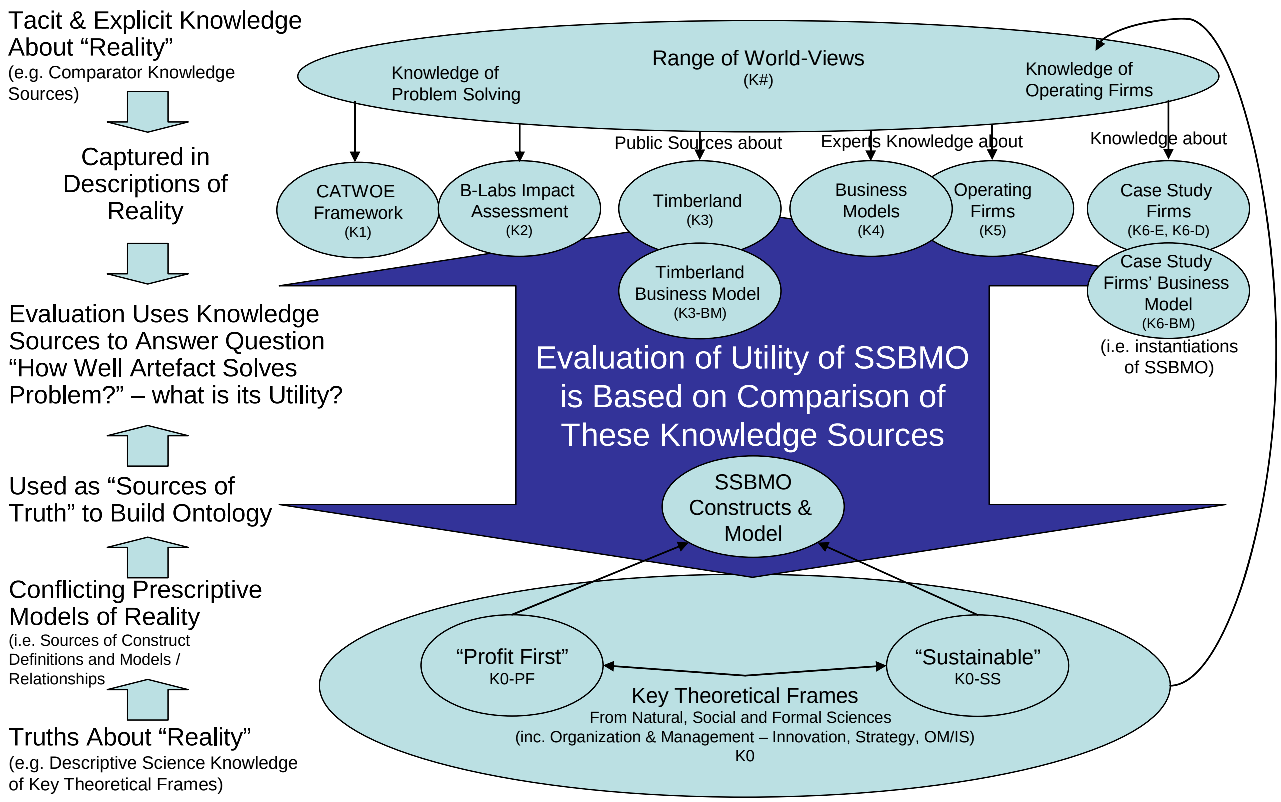


Figure 6-4: Relationship of Knowledge Sources for the Build and Evaluation of the SSBMO (K0 thru K6)

6.4.7 Chosen Metrics

6.4.7.1 Overview

With the research objectives in mind (Chapter 2 and 3.6.6), and considering the advice from the literature Table 6-22 lists the 13 dyads of positive and negative metrics selected to evaluate the SSBMO.

Research Objective (see 3.6.6**)**	**Aspect of Utility**	**SSBMO Metric**		**Research Output Elements**
		Elicit Positive / Confirmatory Feedback	*Elicit Negative Feedback / Opportunity to Improve Design*	
RO0. Maximize Rigor, minimize bias in evaluation process	Context	**M1**: High expectation of likeness relationship between situation & model	Low expectation of likeness relationship between situation & model	Constructs, Model and Instantiations together
	Context	**M2**: High desirability of the model in relation to the situation	Low desirability of the model in relation to the situation	Constructs, Model and Instantiations together
	Context	**M3**: High importance of the model in relationship to identifying relevant change in a situation	Low importance of the model in relationship to identifying relevant change in a situation	Constructs, Model and Instantiations together
RO1. Increasing the quality of strongly sustainable business models:				
RO1a. Reliability of resulting business models	Completeness	**M4**:Completeness	Incompleteness	Constructs, Model
	Completeness	**M5**: Level of detail satisfactory	To much or too little detail	Constructs, Model
	Quality	**M6**: Comprehensibility	Incomprehensible	Constructs, Model
	Quality	**M7**: Real-world likeness to artefact	Unrepresentative of real-world	Constructs, Model
RO1b. Consistency of resulting business models	Quality	**M8**: Internally consistent	Internally inconsistent	Model (relationships between constructs)
RO1c. Effectiveness of resulting business models	Generic	**M9**: Useful, has utility, to intended user	Not useful or produces adverse / unwanted effects	Instantiations
	Beauty	**M10**: Elegance	Inelegant	Constructs, Model, Instantiation
RO2. Increasing the efficiency of business model designers who create those businessmodels	Completeness	**M4**: Completeness	Incompleteness	Instantiation
	Quality	**M6**: Comprehensibility	Incomprehensible	Instantiation
	Quality	**M11**: Easy to use	Hard to use	Instantiation

Table 6-22: Evaluation Metrics for each SSBMO Research Objective and Research Output Component

Feedback may also be received on other metrics which are not defined above (Mx). These will be considered and, if values of any such metrics are derived from the feedback these will be recorded in Chapter 8.

6.4.7.2 Metric Filtering Scheme

These metrics offer a range of aspects to help assess the achievement of the research objectives for each of the research output elements. They were selected using the following filtering scheme, applied in this sequence:

1. Identify the 'best' way of measuring research objective based on the literature and my own knowledge and experience
2. Attempt to ensure all aspects of utility will be measured
3. Attempt to ensure all research output elements will be measured
4. Attempt to select metrics that have proven track record in similar research (Al-debei, 2010; Bullinger, 2008; Osterwalder, 2004a)
5. Attempt to select metrics that have been defined in the literature
6. Attempt to select metrics whose operationalization has been described in similar research (i.e. questions to elicit values of the metrics within a given technique, such as an interview, have been documented)

6.4.7.3 Metric Definitions

Table 6-23 provides the working definitions for each of the metrics. These definitions were based, where available on definitions provided in the literature (Table 6-10).

Aspect of Utility	**Elicit Positive / Confirmatory Feedback**	**Elicit Negative Feedback / Opportunity to Improve Design**	**Definition of Selected Metric**
Context	**M1**: High expectation of likeness relationship between situation and model	Low expectation of likeness relationship between situation and model	"The comparison [SSM evaluation] activity operates in the context of some, often implicitly, expectation of a likeness relationship between situation and model" (Ledington & Ledington, 1999, p.333). "For any relevant [artefact] it is possible ask 'what degree of expectation is associated with the model? Do we expect it to be like the situation?'" (Ledington & Ledington, 1999, p.334)

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design	Definition of Selected Metric
Context	**M2**: High desirability of the model in relation to the situation	Low desirability of the model in relation to the situation	"That comparison will be carried out in a context in which the relevant system/model has some, often implicit, desirability in relationship to the situation" (Ledington & Ledington, 1999, p.334). "For any relevent [artefact] it is possible ask 'is it desirable or undesirable?'" (Ledington & Ledington, 1999, p.334)
Context	**M3**: High importance of the model in relationship to identifying relevant change in a situation	Low importance of the model in relationship to identifying relevant change in a situation	"Comparison will operate in a context in which a model is seen to have importance in relation to identifying relevant change in a situation" (Ledington & Ledington, 1999, p.334). "For any relevant [artefact] it is possible ask 'Is it important or unimportant?'" (Ledington & Ledington, 1999, pp.334)
Complete ness	**M4:** Completeness	Incompleteness	Does the feedback from the knowledge sources that are compared to the SSBMO suggest these knowledge sources can or cannot be conceptualized by the constructs and model of the SSBMO? (Will business models described by the SSBMO be reliable descriptions? Will the risk to businesses who instantiate based on their business models being described using the SSBMO be lower than for businesses who do not use the SSBMO – i.e. will the SSBMO increase the efficiency of business model designers?)
Complete ness	**M5:** Level of detail satisfactory	To much or too little detail	Does the feedback from the knowledge sources that are compared to the SSBMO suggest the constructs and model of the SSBMO have too much or not enough internal structure? (Will business models described by the SSBMO be reliable descriptions?)
Quality	**M6:** Comprehensibility	Incomprehensibility	Does the feedback from the experts and case firm employee knowledge sources suggest the constructs and model of the SSBMO are or are not understood by these people? (Will business models described by the SSBMO be reliable descriptions? Will the risk to businesses who instantiate based on their business models being described using the SSBMO be lower than for businesses who do not use the SSBMO – i.e. will the SSBMO increase the efficiency of business model designers?)
Quality	**M7:** "Real-world" Likeness to Artefact	Artefact Unrepresentative of "Real-world"	"To what extent is there a likeness between the model and the situation; that is to what extent can the situation be conceptualized in terms of t he elements expressed in the conceptual model" (Ledington & Ledington, 1999,p333). (Will business models described by the SSBMO be reliable descriptions?)
Quality	**M8:** Internally Consistent	Internally Inconsistent	Does any feedback from the experts and case firm employees indicate that the definitions used for the SSBMO constructs and model are or are not consistent? (Will business models described by the SSBMO be consistent descriptions?)

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design	Definition of Selected Metric
Generic	**M9**: Useful, has utility, to intended user	Not useful or produces adverse or unwanted effects	Ability to for an expert or case firm employee to recognize and reason with a business model described using the SSBMO – irrespective of intended level of sustainability. or " 'To what extent is it meaningful to think of the situation in terms of the language of the model?' In other words, what are the implications of conceptualizing the situation in the terms expressed in the model?" (Ledington & Ledington, 1999, p.338) (Will business models described by the SSBMO be useful to business model designers?)
Beauty	**M10**: Elegance	Inelegant	Do the experts and case firm's employees believe that the effectiveness of the business models described using the SSBMO have some merit beyond the constructs and model.
Quality	**M11**: Easy to use	Hard to use	Do the experts and case firm's employees believe that the effectiveness of strongly sustainable and/or profit first business model designers using the SSBMO to describe existing or planned business models will be improved over business model designers who do not use the SSBMO?

Table 6-23: Definition of Selected Metrics for Evaluation of SSBMO Utility

6.4.7.4 Metric Operationalization

Values of the metrics will be captured using specific techniques (described in the next section, 6.4.8). For each metric and each technique (see Table 6-25), specific questions to gather and interpret the value of that metric via that technique will be defined (see sections 6.5-6.7).

6.4.8 Chosen Techniques for Gathering Valid Values of the Metrics

6.4.8.1 Evaluation Techniques – Fundamentally About Comparison

A key insight gained from the review of all three fields of the literature is that evaluation of a designed artefact is fundamentally about comparison of some source of knowledge from outside the artefact (and not used to construct the artefact), to the artefact, its constructs, model or instantiation (From the ontology engineering literature see: Brank et al., 2005; From the MIS design science literature see:Hevner et al., 2004; From the SSM literature see: Ledington & Ledington, 1999).

The variability in the sources of knowledge (e.g. human, documentary, etc.) and the components of the designed artefact (i.e. the research output elements) will create the need to vary the techniques used to gather and interpret the values for the metrics. But all the literature is strongly suggestive that all the techniques, at a fundamental level, rely on a process of comparison.

6.4.8.2 Direction of Comparison

However, there is some disagreement between these fields about the direction of that comparison: source of comparator knowledge to artefact or vice versa. For example from design science, Cleven et. al. make it clear in their framework for designing design science research, that the first item in the comparison is either the artefact or the research gap and the second item is either the research gap or the "real-world" (see Table 6-2).

However, from the soft systems perspective, Ledington and Ledington state, and I concur, that this direction of comparison is "nonsense", since "the conceptual model [the SSM artefact] is built entirely from a root definition and structured according to logic. Why should some version of this model exist in reality? Indeed what is the mechanism by which such a model causes a version of itself to exist?" (Ledington & Ledington, 1999, p.333).

These authors suggest, and I concur, that the appropriate direction of comparison is to ask "to what extent is their a likeness between the model and the situation; that is to what extent can the situation be conceptualized in terms of the elements expressed in the conceptual model" (Ledington & Ledington, 1999, p. 333).

6.4.8.3 Chosen Techniques for Gathering Valid Values of the Metrics

Hence in this research the direction of comparison, will be from "real-world" data sources to the designed artefact. This direction of comparison is designed into all the techniques to be used in the evaluation of the SSBMO.

Table 6-24 summarizes the comparator knowledge sources (Table 6-21), the design artefact to be compared, the technique grouping (Table 6-15) [25], the chosen technique, and the research output elements which are to be measured using that technique.

The first two columns of the table express, in the form of a generic evaluation question, the direction of comparison from the comparator knowledge source (first column) to design artefact (second column).

Please refer to 6.2.7 "Techniques for Capturing the Values of the Metrics" for details and citations of the sources for these techniques.

Identifying the specific metrics to be measured using each technique will be presented in the next sub-section (6.4.9).

[25] There is an argument that all the evaluation techniques being applied are from the "descriptive" grouping, rather than analytical (Hevner, March, Park, & Ram, 2004, Table 2 p.86). Osterwalder takes this stance. However, one can argue that only the steps occurring during the Prepare and Build activities (see 4.2.1.5 and 5.2.5.2 respectively) fit Hevner's descriptive techniques, where as the techniques to be used in the evaluation activities are analytical. Bullinger takes this stance, and I concur.

Comparator Knowledge Source *Is there a recognition, fit, likeness of this knowledge…*	Designed Artefact *…within this designed artefact? How complete, comprehensive, natural is this recognition, fit, likeness?*	Technique Grouping	Technique	Research Output Component
K1. CATWOE	SSBMO design based on "profit-first" (K0-PF) and "strongly-sustainable" (K0-SS) key theoretical frames	Analytical	CATWOE (a form Static Analysis)	Constructs, Model
K2. B Lab Impact Assessment Survey v3	SSBMO design based on "profit-first" (K0-PF) and "strongly-sustainable" (K0-SS) key theoretical frames	Analytical	Golden Standard / Data Driven / Assessment by Humans (a form of Static Analysis)	Constructs, Model
K3. Public knowledge of The Timberland Company's business model	SSBMO design based on "profit-first" (K0-PF) and "strongly-sustainable" (K0-SS) key theoretical frames	Experi-mental	Application / Assessment by Humans (a form Simulation)	Constructs, Model
K1. CATWOE	The Timberland Company business model (K3-BM) described using SSBMO & SSBMC based on publically available information on Timberland (K3)	Analytical	CATWOE (a form of Static Analysis)	Example Instantiation
K4. Expert 3rd Parties – knowledge of business model	SSBMO design based on "profit-first" (K0-PF) and "strongly-sustainable" (K0-SS) key theoretical frames	Observation	Semi-structured Interview	Constructs, Model
K5. Expert 3rd Parties – knowledge of operating organizations	The Timberland Company business model (K3-BM) described using SSBMO & SSBMC based on publically available information on Timberland (K3)	Observation	Indirect Case Study including Semi-structured Interview	Example Instantiation
K1 CATWOE	Business model of case study firm (K6-BM1 thru 3) described using SSBMO & SSBMC based on data gathered from case study firm's employees (K6-E1 thru 3) and other data sources (K6-D1- thru 3)	Analytical	CATWOE (a form of Static Analysis)	Specific Instantiation
K6 Employees working for selected case study firms (K6-E#)	Business model of case study firm (K6-BM1 thru K6-BM3) described using SSBMO & SSBMC based on data gathered from case study firm's employees (K6-E1 thru 3) and other data sources (K6-D1 thru 3)	Observation	Direct Case Study, including Semi-structured Interview	Specific Instantiation

Table 6-24: Evaluation Techniques, Required Comparator Knowledge Sources and Design Artefacts for each SSBMO Research Output Component

6.4.9 Activity Groups within Evaluation

6.4.9.1 Introduction

The previous sections 6.4.2 thru 6.4.8 have described the output from the first seven of the nine steps for designing the evaluation activities (6.3.4). In this section, the output of the eighth step is described, a synthesis of the output from the first seven steps. This synthesis identifies the evaluation activity groups within the evaluation activity stream as shown in Figure 6-5.

As shown in Figure 6-5 the evaluation activity stream consists of four activity groups (and a number of sub-groups of which two are shown). Each evaluation activity group takes as input the overall research design, research objectives (RO0-2, Chapter 3, 3.6.6) and the design artefacts (SSBMO, Chapter 7). These inputs are then used by each of the activity groups as follows:

E1. **Comparative Analysis**. Produces comparator knowledge sources K1-3, described in Chapter 8. The results of this activity group are used during the build activity stream (activity group D3) to finalize the third iteration of the SSBMO and create the SSBMC (The build process is described in Chapter 5, and its results in Chapter 7).

E2. **3rd Party Review**. Produces comparator knowledge sources K3-5, described in Chapter 8. The results of the sub-activity group E2a are used during the build activity stream (activity group D3) to finalize the third iteration of the SSBMO and the SSBMC (The build process is described in Chapter 5, its results in Chapter 7).

E3. **Case Study**. Produces comparator knowledge sources K1 and K6, described in Chapter 8

E4. **Feedback Synthesis & Analysis**. Determines the values of all the metrics of utility through synthesis and analysis of all the comparator knowledge sources. These values are then used identify possible improvements to the SSBMO (and SSBMC), described in Chapter 9.

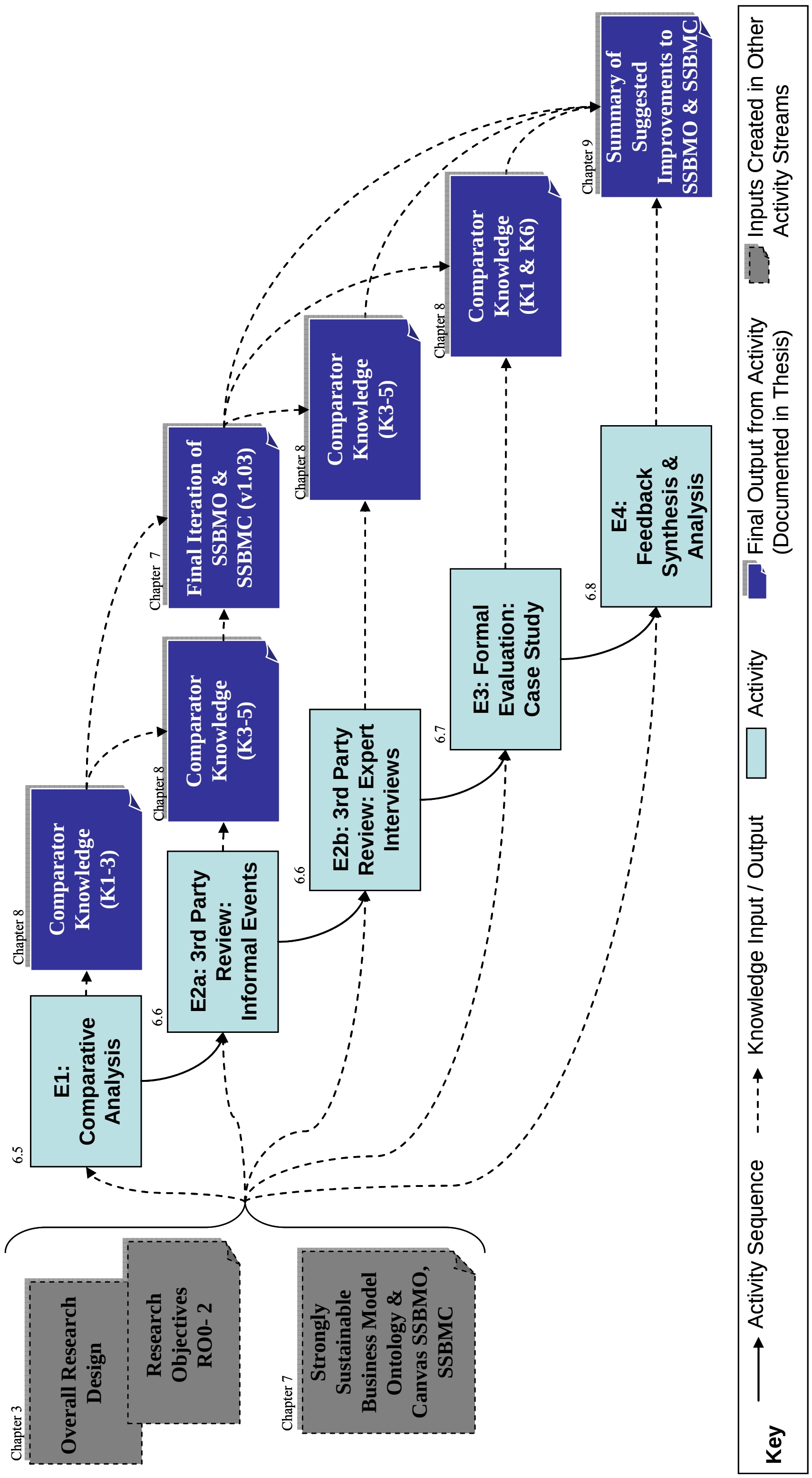


Figure 6-5: Evaluation Activity Groups and Relationships of their Inputs and Outputs

Note that the sequence of execution of tasks within the evaluation activity groups is largely linear; however iteration and recursion were involved that include tasks in different activity groups and indeed in other activity streams.

The synthesis that results in the identification of the first three activity groups (and their sub-groups) is presented in 6.4.9.2. All four groupings and their sub-groups are individually introduced in 6.4.9.3 through 6.4.9.6.

The next section (6.4.10) is the ninth and final step of the evaluation design process (6.3.4): a description of the quality and rigor risk mitigation techniques which are included in the evaluation activity groups.

Sections 6.5 thru 6.8 then describe the details of each of the four evaluation activity groups.

6.4.9.2 Synthesis and Identification of Evaluation Activity Groups

Table 6-25 shows how the first three evaluation activity groups (and their sub-groups) were identified through the synthesis of the outputs from the previous seven steps of the evaluation research design process (6.3.4).

Table 6-25 shows how the activity groups are identified by matching the research output elements to be measured by each evaluation:

- Metric – the rows in this table come from the rows of Table 6-22.

  and

- Technique – the columns in this table come from the rows of Table 6-24.

Research Objective / Aspect of Utility	SSBMO Metric: Elicit Positive / Confirmatory Feedback	SSBMO Metric: Elicit Negative Feedback / Opportunity to Improve Design	Research Output Element								
			Comparison Knowledge Source	CATWOE knowledge of problems (K1)	B Lab Impact Assessment Survey (K2)	Public Knowledge of Timberland (K3)	CATWOE knowledge of problems (K1)	Expert 3rd Parties knowledge of Business Models (K4)	Expert 3rd Parties knowledge of Operating Firms (K5)	CATWOE knowledge of problems (K1)	Employees knowledge of case firms business model (K6-E)
		Comparator Knowledge Sources	**Designed Artefact**	SSBMO Design (K0, K0-PF, K0-SS)	SSBMO Design (K0, K0-PF, K0-SS)	SSBMO Design (K0, K0-PF, K0-SS)	Timberland Business Model (K3-BM based on K3)	SSBMO Design (K0, K0-PF, K0-SS)	Timberland Business Model (K3-BM)	Business Model of Case Study Firms (K6-BM based on K6-E and K6-D)	Business Model of Case Study Firms (K6-BM based on K6-E and K6-D)
			Evaluation Technique	CATWOE technique (a form Static Analysis)	Golden Standard / Data Driven / Assessment by Humans (a form of Static Analysis)	Application / Assessment by Humans (a form Simulation)	CATWOE technique (a form of Static Analysis)	Informal Discussion (E2a) Semi-structured Interview (E2b)	Indirect Case Study	CATWOE technique (a form Static Analysis)	Direct Case Study / Semi-structured Interview
Research Objective / Aspect of Utility	**Elicit Positive / Confirmatory Feedback**	**Elicit Negative Feedback / Opportunity to Improve Design**	**Research Output Element**	Constructs, Model	Constructs, Model	Constructs, Model	Example Instantiation	Constructs, Model	Example Instantiation	Specific Instantiation	Specific Instantiation
RO0. Rigor	**M1**: High expectation of likeness relationship between situation and model	Low expectation of likeness relationship between situation and model	Constructs, Model and Instantiations together	E1a	E1b	E1c	E1c	E2a, b	E2b	E3	E3
	M2: High desirability of the model in relation to the situation	Low desirability of the model in relation to the situation	Constructs, Model and Instantiations together	E1a	E1b	E1c	E1c	E2a,b	E2b	E3	E3
	M3: High importance of the model in relationship to identifying relevant change in a situation	Low importance of the model in relationship to identifying relevant change in a situation	Constructs, Model and Instantiations together	E1a	E1b	E1c	E1c	E2a,b	E2b	E3	E3
RO1a. Reliability: Completeness	**M4:** Completeness	Incompleteness	Constructs, Model	E1a	E1b	E1c		E2a, b			
RO1a. Reliability: Completeness	**M5**: Level of detail satisfactory	To much or too little detail	Constructs, Model	E1a	E1b	E1c		E2a, b	E2b		
RO1a. Reliability: Quality	**M6**: Comprehensibility	Incomprehensible	Constructs, Model					E2a, b	E2b		
	M7: Real-world likeness to artefact	Artefact unrepresentative of real-world	Constructs, Model					E2a, b	E2b		
RO1b. Consistency: Quality	**M8**: Internally consistent	Internally inconsistent	Model	E1a	E1b	E1c					
RO1c. Effectiveness: Generic	**M9**: Useful, has utility, to intended user	Not useful or produces adverse or unwanted effects	Instantiations				E1c	E2b	E2b	E3	E3
RO1c. Effectiveness: Beauty	**M10**: Elegance	Inelegant	Constructs, Model, Instantiation					E2b	E2b		E3
RO2. Efficiency: Completeness	**M4**: Completeness	Incompleteness	Instantiation				E1c		E2b	E3	E3
RO2. Efficiency: Quality	**M6**: Comprehensibility	Incomprehensible	Instantiation						E2b		E3
RO2. Efficiency: Quality	**M11**: Easy to use	Hard to use	Instantiation						E2b		E3

Table 6-25: SSBMO Evaluation Activity Groups

Based on Synthesis of Outputs from Steps One thru Seven of the Evaluation Research Design Process (see 6.3.4)

Where the research output elements are in common between the rows and columns an evaluation activity group (E1 thru E3) is identified. In some cases the evaluation activity groups will have a number of sub-groups, labelled a thru c, e.g. E1a, E1b, E1c, etc.

6.4.9.3 Comparative Analysis (E1)

Introduction

The purpose of this group of evaluation activities is to provide the researcher with 'first-order' feedback on the utility of the SSBMO in fulfilling its objectives (Chapter 2, 3.6.6); it would be imprudent to take a designed artefact to any 3rd parties until the researcher has some minimal confidence in its utility.

This group of evaluation activities is approximately equivalent to a (small) portion of the comparison activities in SSM step 5, that are focused on using a range of generalized knowledge about the problem / situation to check for completeness of root definitions and models based on the world-views of the participants[26].

Hence this group of evaluation activities required the researcher to use a variety of static analysis techniques to compare a variety knowledge sources (K1 thru K3) against the constructs and models of the SSBMO design.

Since these activities are carried out by the researcher themselves, an alternative name for this group of evaluation activities could be "self-validation" or "designer validation".

Other design science ontology researchers have used this overall "self-validation" approach using analytical static analysis (Bullinger, 2008), or descriptive comparison process (Osterwalder, 2004a).

[26] See Table 6-3 – Evaluation Type A

The different comparator knowledge sources create the need for three sub-groups of evaluation activities, as follows:

E1a Comparative analysis using the CATWOE (K1) knowledge source to determine if there is a recognition, fit or likeness of the CATWOE knowledge within the constructs and / or models of the designed artefact, i.e. the SSBMO design based on “profit-first” (K0-PF) and “strongly-sustainable” (K0-SS) key theoretical frames.

E1b Comparative analysis using the B Lab Impact Assessment Survey v3 (K2) knowledge source to determine if there is a recognition, fit or likeness of the B Lab Impact Assessment Survey knowledge within constructs and/or models of the designed artefact, i.e. the SSBMO design based on “profit-first” (K0-PF) and “strongly-sustainable” (K0-SS) key theoretical frames.

E1c Comparative analysis using the public knowledge of The Timberland Company’s business model (K3) to determine if there is a recognition, fit or likeness of the Timberland Company business model knowledge within the constructs and / or models and / or example instantiations of the designed artefact, i.e. the SSBMO design based on “profit-first” (K0-PF) and “strongly-sustainable” (K0-SS) key theoretical frames.

Use of the SSBMC

In addition to documenting the Timberland business model (K3) using a tabular / spreadsheet instantiation of the SSBMO (and PowerPoint summary, 5.4.7), K3 is also summarized using the SSBMC, by applying sticky notes (5.4.8).

Summary

Figure 6-6 summarizes this evaluation activity group.

Details of operationalization of the identified analytical techniques to capture the values of the relevant metrics of utility are described in 6.5 below.

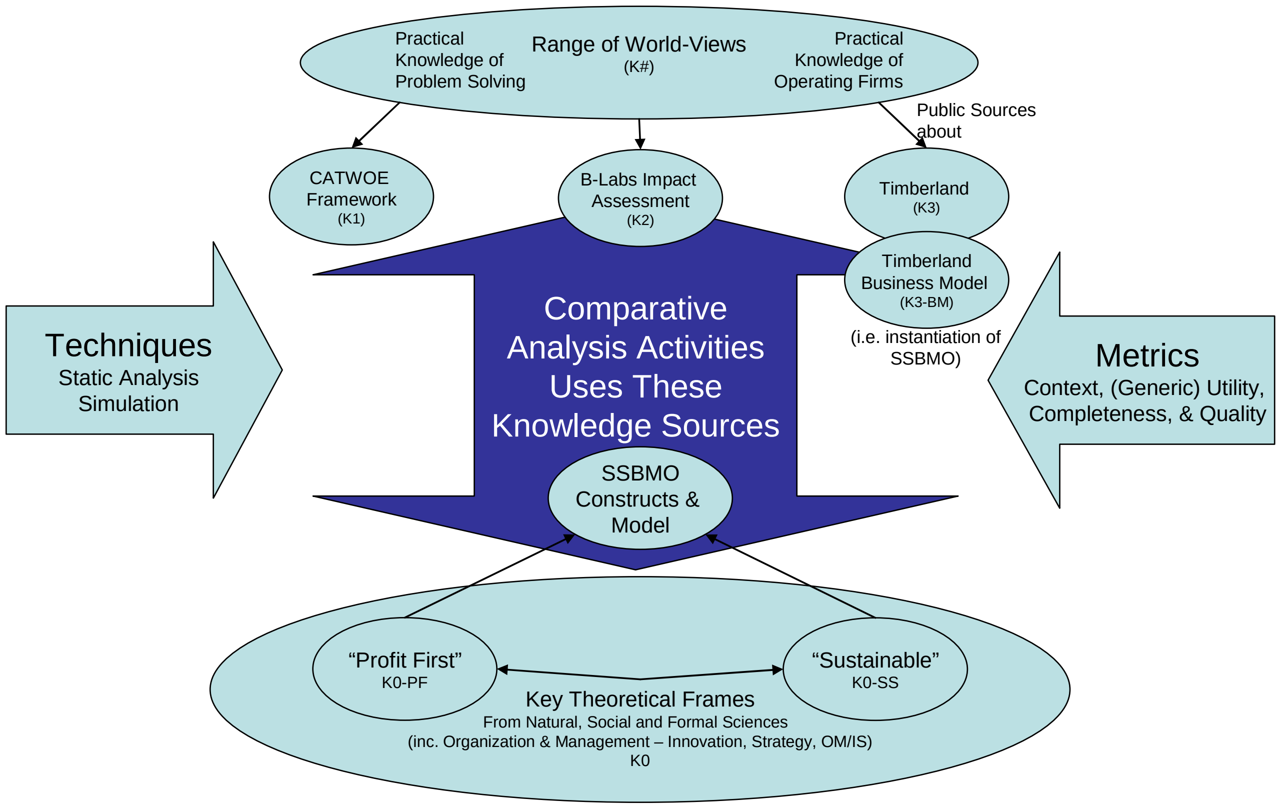


Figure 6-6: Summary of Knowledge Sources, Techniques and Metrics used in Comparative Analysis Evaluation Activity Group (E1)

6.4.9.4 3rd Party Review (E2)

The purpose of this group of evaluation activities is to provide the researcher with "second-order" feedback on the utility of the SSBMO in fulfilling its objectives (Chapter 2, 3.6.6). This is achieved by using knowledge from a range of 3rd parties, but where the business model of the organization the 3rd parties are associated with is not a comparator knowledge source, i.e. the 3rd parties are experts not employees of a firm that is a specific case under investigation.

This group of evaluation activities is approximately equivalent to the comparison activities in SSM step 5 (comparison using a range of "generalized" expertise/knowledge, but not a specific situation / problem with the root-definitions, models and example instantiations of the model). This further validates the root definitions and models and provides additional opportunities for learning about the situation / problem and the root definitions / model[27].

Hence this group of evaluation activities involves the researcher engaging with a variety of 3rd party experts who have a range of world-views about the social purpose of business from profit first to strongly sustainable. Using observational techniques (semi-structured interview, indirect case study) the 3rd party review evaluation activities aim to undertake two comparisons:

1. The experts' knowledge of business models (K4) and the SSBMO design, which in turn is based on profit-first (K0-PF) and strongly-sustainable (K0-SS) key theoretical frame knowledge sources. This will determine if there is recognition, fit or likeness of the former knowledge source within the latter, i.e. constructs and models of the SSBMO design.
2. The experts' knowledge of operating organizations business models (K5) and an example instantiation of the SSBMO, specifically The Timberland Company business model (K3-BM) described using SSBMO and SSBMC based on publically available information on Timberland (K3). (This example instantiation is prepared by the researcher as part of the evaluation activities E1c). This will determine if there is a recognition, fit or likeness of the former knowledge source within the latter, i.e. the constructs, models and example instantiation of the SSBMO design.

Other design science ontology researchers have used this overall "3rd party review" approach using observational (Bullinger, 2008), or descriptive comparison process (Osterwalder, 2004a).

Bullinger uses the same basic approach at approximately the same stage of her ontology development (e.g. equivalent to my 3rd iteration, build activity D3) (Bullinger, 2008, p.250).

[27] See Table 6-3 – Evaluation Type A

Additional insight into the best practices for undertaking semi-formal interview based qualitative research was gained from three seminars offered by the University's Institute for Social Research[28] as well as the work of Roulston (2010).

It was thought wise to gain some external feedback on the SSBMO design, adding some initial "second-order" feedback to the "first-order" feedback gathered in the comparative analysis evaluation activity group (E1). Gathering some external feedback was considered important prior to completing build activity D3 and the iteration of the SSBMO to be evaluated via formal interaction with 3rd party sources of comparator knowledge. Hence the 3rd party review was split into informal and formal steps, as follows:

E2a Informal 3rd party review of SSBMO during build activity D3. This is intended to gather 'simple' 'informal' 'face-value' feedback, gathering values of the identified metrics in an opportunistic manner.

E2b Formal 3rd party review of the SSBMO after build activity D3 is complete and prior to build activity D4. This is intended to formally gather values of the identified metrics in a structured manner.

Use of the SSBMC

During E2a and E2b the experts are shown the Timberland business model (K3) in a tabular / spreadsheet instantiation of the SSBMO (and PowerPoint summary, 5.4.7). The experts were also shown K3 as summarized using the SSBMC, by applying sticky notes (5.4.8).

The use of the SSBMC, "simplified visually attractive tool powered by and hence compatible with, the SSBMO" is intended to gather feedback on the SSBMO by offering experts a more accessible version of the SSBMO.

[28] Seminars attended were offered by York University Institute for Social Research entitled "The Art and Science of Research Interviewing" taught by Profs. Raymond Garrison and Bryn Greer-Wootten (May 2, 2011), "Interpreting Qualitative Data: An Overview" taught by Prof. Raymond Garrison (May 4, 2011), and "Using Computers in Qualitative Analysis: An NVivo 9 Workshop" taught by Prof. Palema Grassau (May 3-4, 2012) http://www.isr.yorku.ca/courses/sss2011/index.html and http://www.isr.yorku.ca/courses/sss2012/index.htm.

Summary

Figure 6-7 summarizes this evaluation activity group.

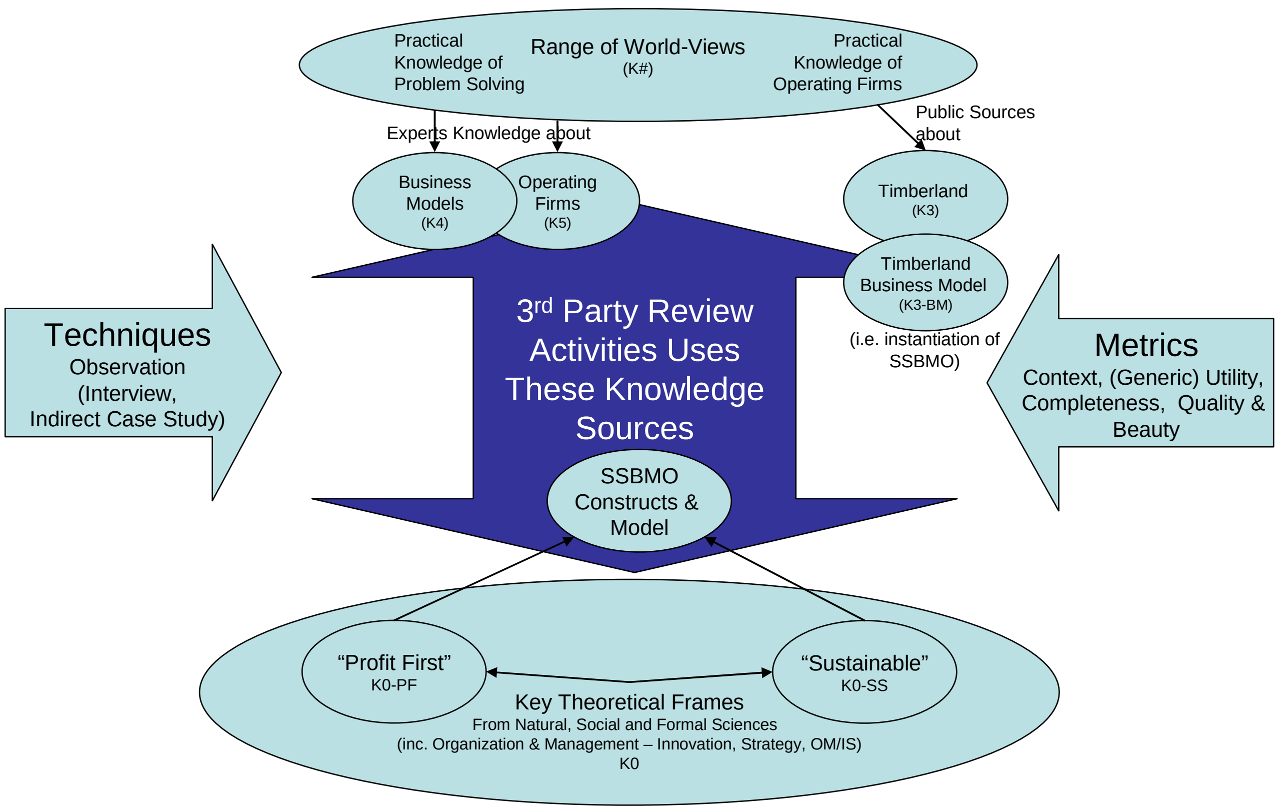


Figure 6-7: Summary of Knowledge Sources, Techniques and Metrics used in 3rd Party Review Evaluation Activity Group (E2)

Details of operationalization of the identified observational techniques to capture the values of the relevant metrics of utility are described in 6.6 below.

6.4.9.5 Case Study (E3)

The purpose of this group of evaluation activities is to provide the researcher with "second-order" feedback on the utility of the SSBMO in fulfilling its objectives (Chapter 2, 3.6.6) from a range of cases, where the specific business model of each case firm is the comparator knowledge source.

This group of evaluation activities is approximately equivalent to the comparison activities between SSM step 7 and SSM step 1 of the next iteration of the SSM cycle (comparison of the specific situation that arises once the design is instantiated, i.e. there is requirement for specific knowledge of the resulting situation). This validates the ability of the designed solution to successfully resolve the original problem situation, or if not, provides additional opportunities for learning about the situation / problem and designed solution[29].

Hence this group of evaluation activities involves the researcher engaging in a variety of cases each of which embodies a different world-view about the purpose of business from profit first to strongly sustainable, and their progress to operationalizing that world-view. Using analytical (CATWOE static analysis), and observational techniques (direct case study), the cases aim to undertake two comparisons:

1. Static analysis using the CATWOE (K1) knowledge source to determine if there is a recognition, fit or likeness of the CATWOE knowledge within the Business Model of the case in question (K6-BM1 thru 3) described using the SSBMO based on data gathered from the case study firms firm's Employees (K6-E1 thru 3) and other Data sources (K6-D1 thru 3). This test of completeness will serve the dual purpose of confirming the case business model is ready for the second comparison (described below), and providing feedback on the completeness of the SSBMO at representing actual operating firms' business models (in a similar manner to evaluation activity group E1c – The Timberland Company).
2. The case firm employees' knowledge of their organizations business model (K6-E1 thru 3) and the business model of the same case study firm (K6-BM1 thru 3) described using the SSBMO and SSBMC based on data gathered from case firm's employees (K6-E1 thru 3) and other data sources (K6-D1 thru 3). This will determine if there is a recognition, fit or likeness of the former knowledge source within the latter, i.e. do the employees of the case firm recognize their business model when it is presented to them described using the SSBMO and SSBMC, and is this perspective on their business model useful.

[29] See Table 6-3 – Evaluation Type B

Other design science ontology researchers have used this overall case study approach to help evaluate their ontologies (Al-debei, 2010; Bullinger, 2008; Osterwalder, 2004a).

Additional insight into the best practices for undertaking case study research was obtained from the following sources (Flyvbjerg, 2006; Tellis, 1997; Yin, 2009, Chapter 2 "Designing Case Studies" pp.28-65). Insight into the best practices for undertaking semi-formal interview based qualitative research was gained from three seminars offered by the University's Institute for Social Research Finally, as well as the work of Roulston (2010).

Use of the SSBMC

In addition to documenting the case firm's business models (K6-BM1-3) using a tabular / spreadsheet instantiation of the SSBMO (5.4.7), K6-BM1-3 is also summarized using the SSBMC, by applying sticky notes (5.4.8).

The use of the SSBMC, "simplified visually attractive tool powered by and hence compatible with, the SSBMO" is intended to gather feedback on the SSBMO by offering the case study firm employees a more accessible version of the SSBMO.

Summary

Figure 6-8 summarizes this evaluation activity group.

Details of operationalization of the identified analytical and case study techniques to capture the values of the relevant metrics of utility are described in 6.7 below.

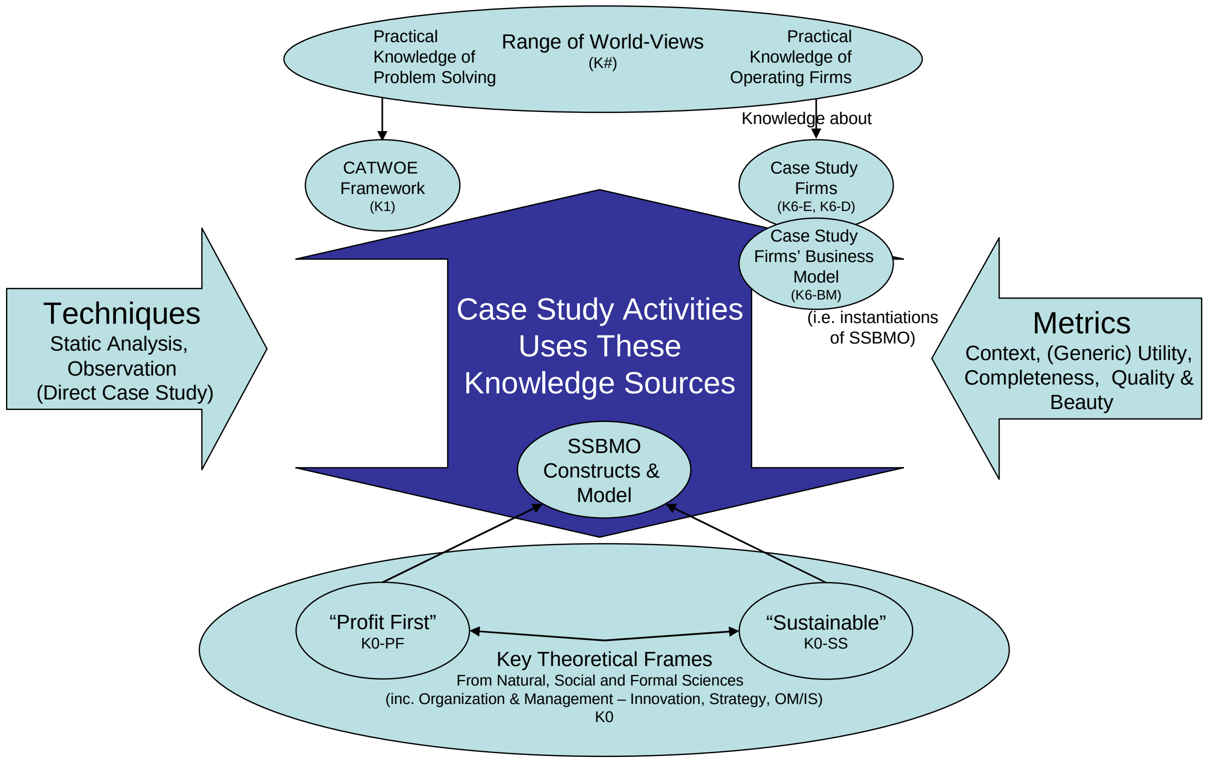


Figure 6-8: Summary of Knowledge Sources, Techniques and Metrics used in Case Study Evaluation Activity Group (E3)

6.4.9.6 Feedback Synthesis & Analysis (E4)

As shown in Figure 6-5, the values of the metrics captured by evaluation activity group:

- E1, comparator knowledge K1-K3, and E2a, comparator knowledge K3-K5, are determined in E4 and are documented in Chapter 8 and applied to create the final output of build activity group D3 described in Chapter 7.
- E2b, comparator knowledge K3-K5, and E3 comparator knowledge K6, are determined in E4 and are documented in Chapter 8 and then used as input into build activity group D4, described in Chapter 9.

In addition to determining the values of the metrics activity group E4 synthesizes and analyzes the feedback on the utility of the SSBMO. Following the determination of the metric values, these are compared with the research question (RQ), research objectives

(RO0-2), the working hypothesis (WH1-4) and evaluation hypothesis (see below). This leads to the identification of gaps between the desired level of utility and the achieved level of utility (GU1-n). Where apparent gaps between desired and achieved or possible levels of research design rigour are also notes (GR1-n). The gaps are also documented in Chapter 8.

The identified gaps (GU1-n and GR1-n) are then input into activity group D4 which develops the summary candidate improvements to the SSBMO and SSBMC that might lead to improved utility (CU1-n) and research rigour (CR1-n). These candidates for improvement are described in Chapter 9.

6.4.10 Chosen General Techniques Increasingly Likelihood of Collecting Valid Metric Values

In any qualitative research there are a number of widely recognized challenges and risks to achieving rigorous high quality research results. There are also a widely recognized set of techniques to mitigate these risks.

Table 6-26 identifies the risks believed to be applicable to the evaluation of the SSBMO. The table also describes and justifies the overall techniques to be used to mitigate these risks and increase the likelihood of collecting valid values of the evaluation metrics using the chosen techniques.

Research Quality Challenges / Risks	Typical Risk Mitigation Technique	Applied in Which Research Design Activity
Not gathering appropriate data in valid manner	Detailed definition of metrics and techniques in relation to research problem prior to commencing field work	Prior to commencing evaluation stage: The content of this chapter[30]

[30] In the language of Yin's four tests for assessing the quality of any empirical social research this approach helps ensure: "construct validity: identifying correct operational measures for the concept being studied; external validity: defining the domain to which a study's findings can be generalized; and reliability: demonstrating that the operations of a study – such as the data collection procedures – can be repeated, with the same results." (Yin, 2009, pp.40-45).

Research Quality Challenges / Risks	Typical Risk Mitigation Technique	Applied in Which Research Design Activity
Confirmation bias, i.e. finding only what you are looking for	Making explicit expectations of designer	Build: Expectations / Desirability Matrix Evaluation: identification of positive and negative metric dyads – every time a metric is measured its positive and negative aspect will be considered. Evaluate: Analysis of all feedback gathered
Insufficient variety in data sources	Attempt to get feedback from multiple sources with similar and divergent world views in similar and different industry sectors, sizes, etc. Attempt to get feedback from sufficient numbers of sources, such that if one turns out not to be competent it can be ignored without impacting overall research validity.	E1a. Comparative Analysis – CATWOE – conceptual E2a. 3rd Party Review – Informal – group setting E2.,3rd Party Review – Formal – range of interviewees E3. Case Study – range of firms
Incomplete recall of field data collection events	Recording interviews	E2b. and E3. via digital audio recorder
	Note taking in interviews	E2b and E3 – researcher only; within scope of this research not possible to have 2nd person present.
	Transcribing interviews	E2b and E3. Professional transcription.
	Reviewing written transcripts of interviews	E2b and E3. Interviewees will be asked to review written transcripts of their feedback.
	Reviewing written summaries of feedback based on analysis of interviews.	E2b and E3. Interviewees will be asked to review summary of their feedback.
	Accuracy and sufficiency of record keeping to ensure formal chain of evidence	Evaluate: all activities: Established electronic record keeping framework (structure of folders, planned documents in relation to each research activity etc.) as well as backup protocol.
	Maintaining research log books	Evaluate: all activities: electronic log books established and being kept
	Comprehensive documentation of intermediate and final work products	Evaluate: all activities: Established electronic record keeping framework (structure of folders, planned documents etc.)

Table 6-26: Identification of Risks and Application of Mitigation Techniques in All Evaluation Activities

6.5 Evaluation Activity Group 1 – Comparative Analysis (E1)

This section describes in detail the research design created to undertake the group of evaluation activities in which I reviewed the SSBMO design artefact against comparator sources of knowledge (K2 and K3).

This work was completed between September 1, 2011 and February 28, 2013.

6.5.1 Introduction to Comparative Analysis

As introduced in 6.4.9.3 the purpose of this group of evaluation activities is to provide the researcher with 'first-order' feedback on the utility of the SSBMO.

Three different knowledge sources will be compared to various components of the SSBMO by the researcher, and the results fed back in to build activity D3 to enable the third iteration of the SSBMO build to be completed.

It is intended the experience and knowledge gained from executing this feedback loop will improve the utility of the SSBMO (or confirm the utility of the initial iteration of the SSBMO design prepared at the start of build activity D3) prior to consulting 3rd party experts (E2) and employees in the case firms (E3).

The following three sections (6.5.2-6.5.4) describe in detail the protocols to be used for the comparison of the three knowledge sources against various components of the SSBMO.

6.5.2 Comparative Analysis Using the CATWOE (K1) Knowledge Source (E1a)

6.5.2.1 Origins

The inspiration to consider using the CATWOE knowledge source came during a December 5, 2011 presentation of "design science, systems thinking, and the creation of ontologies" to Prof. Martin Bunch's systems thinking seminar group in the York University Faculty of Environmental Studies. At this presentation Prof. Bunch and others highlighted their belief the SSM CATWOE knowledge would be an applicable of assessing completeness of the SSBMO.

The subsequent review of the literature (6.2) confirmed this intuition, and this evaluation activity was added to the research design as a result.

6.5.2.2 Assumptions

The CATWOE framework has been designed to 'force' its user to clarify all relevant aspects of the broad system which is being subject to analysis from the perspective of the users' world-view (Jackson, 2000). It was developed as part of a program of research by Checkland to "tackle what are perceived to be 'problems in the real world', and to do so by the explicit use of systems concepts" (Smyth & Checkland, 1976). The CATWOE technique has subsequently been used and reviewed in multiple contexts, with a body of advice for its use created (Bergvall-Kåreborn, Mirijamdotter, & Basden, 2004; Mobach, van der Werg, & Tromp, 2000; Wilson, 2001, pp.22-34). (Wilson, 2001)

6.5.2.3 Bias

The following potential sources of bias that could influence the capture and values of the metrics to be gathered in this evaluation activity, were identified: this researcher is

- Conducting this analysis by himself, without 3rd person review.
- Not formally trained on the CATWOE framework.

6.5.2.4 Knowledge Sources

Comparative analysis will be conducted using the CATWOE (K1) knowledge source to determine if there is a recognition, fit or likeness of the CATWOE knowledge within the constructs and / or models of the designed artefact, i.e. the SSBMO design based on profit-first (K0-PF) and strongly-sustainable (K0-SS) key theoretical frames.

6.5.2.5 Techniques

CATWOE, a form of static analysis, involves determining whether the SSBMO constructs and model meets the CATWOE criteria from the perspective of the users' world-view, is described as a series of questions documented in the execution protocol below, Table 6-28. (Jackson, 2000).

6.5.2.6 Metrics

Values of the metrics shown in Table 6-27are gathered by this evaluation activity sub-group:

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design
Completeness	**M4**: Completeness	Incompleteness
Completeness	**M5**: Level of detail satisfactory	To much or too little detail
Quality	**M8**: Internally Consistent	Internally Inconsistent

Table 6-27: Metrics Whose Values Are Being Gathered by E1a CATWOE Comparative Analysis Evaluation Activity

6.5.2.7 Evaluation Hypothesis

Considering the expectations / desirability matrix (Table 6-20) the following hypotheses were derived which will be confirmed or refuted during the execution of this sub-group of evaluation activities.

E1a-EH1: The SSBMO constructs and model, being largely based on the profit-first BMO that has a high degree of face validity due to its wide spread acceptance and use, fits well to the CATWOE knowledge source, if one bounds this source to the profit-first world-view. e.g. one assumes the businesses only offer 'positive' value propositions, and that customers desire to be targets of a business as a result of needing these value propositions.

E1a-EH2: A test of how well, during the preparation activities (P), and subsequently applied in the build activities (D1 thru D3) the strongly-sustainable key disciplinary frames have been discovered. An acceptable level of discovery and of application of these knowledge sources is when the SSBMO constructs and model fit well with to the CATWOE knowledge source, if one bounds this source to the strongly sustainable world-view, e.g. one assumes that businesses have 'positive' and 'negative' value propositions, and a variety of stakeholders (not just customers or humans) who can benefit from and be caused harm by their choice to have a relationship with a firm or as a result of being impacted by aspects of a firm's executing business model (i.e. their operations).

6.5.2.8 Execution Protocol

To execute this evaluation activity sub-group the following questions are asked in relationship to the SSBMO constructs and model and a record of the results of this analysis made in the evaluation results documentation. This will include recording the results of testing the above hypothesis using the gathered values of the metrics. Ideas for improving the SSBMO that result from this analysis will also be recorded for use during the completion of activity D3.

The following questions express the CATWOE criteria in relation to the SSBMO constructs and model, and gather values of the metrics shown in Table 6-27 (Bergvall-Kåreborn et al., 2004; Smyth & Checkland, 1976; Wilson, 2001, pp.22-34). Each of the questions will be asked twice, once each from the profit-first and strongly sustainable world-views, in order to gather date for the two evaluation hypothesis (E1a-EH1-2).

CATWOE Element	**Question**	**Metrics**
Clients	Can the constructs and their relationships in the SSBMO represent at an appropriate level of detail the beneficiaries or victims of organizations' business model?	M4: Completeness, Incompleteness, M5: Level of detail satisfactory, To much or too little detail
Clients	Are the relationships between the constructs in the SSBMO able to consistently describe the relationships between the beneficiaries and/or victims of an organization's business model?	M8: Internally consistent, internally inconsistent

CATWOE Element	Question	Metrics
Actors	Can the constructs and their relationships in the SSBMO adequately represent the persons and / or organizations (groupings of persons) that are responsible for the definition and instantiation of a firm's business model (i.e. the creating of an operating firm)?	M4: Completeness, Incompleteness, M5: Level of detail satisfactory, To much or too little detail M8: Internally consistent, internally inconsistent
Transformation	Can the constructs and their relationships in the SSBMO adequately describe the monetary, social and bio-physical inputs, transformations, and outputs required by the overall purpose / objective of a firm?	M4: Completeness, Incompleteness, M5: Level of detail satisfactory, To much or too little detail M8: Internally consistent, internally inconsistent
World-View	Can the constructs and their relationships in the SSBMO adequately represent a range of world-views of the clients and actors, which might cause them to become involved with a firm? e.g. can a range of client and actor needs / wants be represented based on different client world-views.	M4: Completeness, Incompleteness, M5: Level of detail satisfactory, To much or too little detail M8: Internally consistent, internally inconsistent
Owner	Can the constructs and their relationships in the SSBMO adequately represent the authority / power relationships in a firm's business model which could cause the firm to cease to exist and/or change the firm's definition and measures of success (i.e. justification for continuing to exist)?	M4: Completeness, Incompleteness, M5: Level of detail satisfactory, To much or too little detail M8Internally consistent, internally inconsistent
Environmental constraints	Can the constructs and their relationships in the SSBMO adequately represent a range of monetary, social and bio-physical constraints the firm may choose to acknowledge in their business model design?	M4: Completeness, Incompleteness, M5: Level of detail satisfactory, To much or too little detail M8Internally consistent, internally inconsistent

Table 6-28: Evaluation Activity Sub-Group E1a – Questions and Metrics

6.5.3 *Comparative Analysis Using the B Lab Impact Assessment v3 (K2) Knowledge Source (E1b)*

6.5.3.1 Origins

The inspiration to consider an evaluation activity using a knowledge source based on the strongly sustainable world view, but independent of the strongly sustainable key theoretical frames (K0-SS) used during build activities (D1 thru D3) came during a conversation with Prof David. Johnston on July 19, 2011.

Subsequent consideration of which knowledge source to use was based on experience using the B Lab Impact Assessment version 2 in a group course assignment (Drapeau et al., 2010) and telephone discussions with the Head of Certification at B Lab (the owner of the survey instrument). These considerations confirmed the practicality of using this knowledge source, and this evaluation activity was added as a result.

6.5.3.2 Assumptions

The B Lab Impact Assessment survey does a thorough job at evaluating a firm's operation (and by implication its instantiated business model) from a strongly-sustainable perspective[31]. This is based on my understanding of the objectives of B Lab and its Benefit Corporation legal framework and certification standard developed during a course assignment (Drapeau et al., 2010).

It is not necessary to find a profit-first equivalent knowledge source, since the ability of the SSBMO to describe firms who take this world-view has been tested extensively by Osterwalder in his PhD and subsequently via his practitioner work.

[31] An informal comparison of the strongly sustainable key theoretical frames (K0-SS) and the B Lab Impact Assessment Survey (K2) suggests that the B Lab survey embeds a significant portion of the strongly sustainable key theoretical frames. As such it is one of the few organizations encountered that is demonstrating at least some alignment with this world-view, hence the decision to use it in this evaluation. However, note that the knowledge of the attributes of strong sustainability expressed in the key theoretical frames is still 'ahead' of the B Lab Impact Assessment Survey conception of strong sustainability. Clearly, even for organizations such as B Lab who are 'bleeding edge' there are significant challenges adopting the key theoretical frames definition of 'strong sustainability'.

The intention (as per build principle 1, BP1) is for the SSBMO to make the smallest number of changes to Osterwalder's BMO, since the SSBMO is not intended to diminish the ability to describe a profit-first business. If a change has been made that impacts the ability of the SSBMO to describe a profit first business model, or if there are gaps in Osterwalder's BMO, evaluation with 3rd party experts (E2) and cases (E3) who have the profit-first world view provide an opportunity for this to be discovered.

6.5.3.3 Bias

The following potential sources of bias, which could influence the capture and values of the metrics to be gathered in this evaluation activity, were identified: this researcher is

- Conducting this analysis by himself, without 3rd person review.
- Not formally trained on the B Lab Impact Assessment Survey.

6.5.3.4 Knowledge Sources

Comparative analysis will be conducted using the B Lab Impact Assessment Survey v3 (K2) knowledge source to determine if there is a recognition, fit or likeness of the B Lab Impact Assessment Survey knowledge within constructs and/or models of the designed artefact, i.e. the SSBMO design based on profit-first (K0-PF) and strongly-sustainable (K0-SS) key theoretical frames.

6.5.3.5 Techniques

The static analysis comparison of the B Lab Impact Assessment Survey v3 and the SSBMO constructs and model is described in a series of questions in the execution protocol below.

6.5.3.6 Metrics

Values of the metrics shown in Table 6-29 are being gathered by this evaluation activity sub-group:

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design
Completeness	**M4**: Completeness	Incompleteness
Completeness	**M5**: Level of detail satisfactory	To much or too little detail
Quality	**M8**: Internally Consistent	Internally Inconsistent

Table 6-29: Metrics Whose Values Are Being Gathered by E1b B Lab Impact Assessment Survey v3 Comparative Analysis Evaluation Activity

6.5.3.7 Evaluation Hypothesis

Considering the expectations / desirability matrix (Table 6-20) the following hypotheses were derived which will be confirmed or refuted during the execution of this sub-group of evaluation activities.

E1b-EH1: The B Lab Impact Assessment Survey v3 items, being based on a strongly-sustainable world-view, implicitly make use of constructs (ideas) that cannot be described using Osterwalder's BMO which is based on the profit-first world-view. This will provide evidence of the practical nature of the gap identified in the problem statement of this research (Chapter 2).

E1b-EH2: All the constructs and relationships implicitly used in the B Lab Impact Assessment Survey v3 items, being based on a strongly-sustainable world-view, can be described using the SSBMO constructs and model.

E1b-EH3: All the constructs and relationships in the SSBMO are required to represent the constructs and relationships implicitly used in the B Lab Impact Assessment Survey v3 items. This will provide evidence of completeness and satisfactory level of detail.

E1b-EH4: A test of how well I have discovered, during the preparation activities (P), and subsequently applied in the build activities (D1 thru D3) the strongly-sustainable key disciplinary frameworks: An acceptable level of discovery and of application of these knowledge sources is when the SSBMO constructs and model fit well with to the B Lab Impact Assessment Survey v3 knowledge source.

6.5.3.8 Execution Protocol

1. Obtain the version 3 survey items for all types of organizations in all industry sectors from B Lab Head of Certification.

2. Format the survey items to allow the intersection of survey items and SSBMO and BMO constructs to be considered (Excel spreadsheet).

3. Compare the concepts underlying each B Lab Impact Assessment survey item to the concepts and model in

    - Osterwalder's BMO (i.e. profit-first world view)

    - The SSBMO (i.e. strongly-sustainable world view)

4. For each item in the survey consider how easily can each of these ontologies describe the concepts and relationships required in a business model that would result in a response to the item that would score the maximum number of points, i.e. the highest level of sustainability contemplated by B Lab.

    Record in the spreadsheet the degree of ease of representing a business model that would score maximum points in the B Impact Assessment survey, using the 5 point scale shown in Table 6-30.

Score	Degree of Difficulty / Ease of Comparison
1	Concepts very difficult to represent in ontology, i.e. no direct mapping of survey concepts to any constructs and / or the model, i.e. constructs and / or relationships are missing from the ontology
2	Concepts difficult to represent
3	Concepts neither difficult nor hard to represent
4	Concepts easy to represent
5	Concepts very easy to represent in ontology, i.e. direct mapping of survey **item** concepts to one or more constructs and their relationships
0	Not Applicable, i.e. construct(s) in the survey item is not applicable to attempt to describe a business model.

Table 6-30: Scoring Scheme for Comparison of B Lab Impact Assessment Survey (K2), to Osterwalder's BMO (K0-PF) and the SSBMO (K0-SS)

5. Interpret and record these scores individually and in total in the evaluation results documentation. The individual and total scopes are interpreted to arrive at values of metrics as shown in Table 6-31.

Scoring Level*	Interpreted Metric Value
High score for all the constructs and their relationships	M4: High degree of completeness for the ontology Satisfactory completeness
High score for construct and its relationships	M5: High degree of completeness for this construct and its relationship Satisfactory level of detail
Number of 0 (not applicable) scores	M5: Level of detail is too high or low i.e. constructs and their relationships included in B Lab Impact Assessment Survey items dud not map to ontology
High score for a group of constructs and their relationships	M8: High degree of internal consistency within the ontology Satisfactory level of internal consistency

* The opposite scoring level is deemed to have the opposite interpreted metric value, and hence indicates an opportunity to improve the SSBMO.

Table 6-31: Scheme for Interpreting Values of Metrics from Scores in Evaluation Activity Sub-Group E1b

6. Record the interpretations of these scores in the evaluation results documentation. This will include recording the results of testing the above hypothesis using the gathered values of the metrics. Ideas for improving the SSBMO which result from this analysis will also be recorded for use during the completion of activity D3

6.5.4 Comparative Analysis of The Timberland Company (K3) Knowledge Source (E1c)

6.5.4.1 Origins

The inspiration to consider an evaluation activity using a knowledge source of an instantiation of a firm whose world-view is somewhere between strongly-sustainable and profit-first came from a discussion with a Senior Project Manager Partner in a local industrial ecology project and the CEO of a sustainability education provider on September 7, 2011.

Their suggestion had two aspects:

1. Use the SSBMO to describe the business model (i.e. constructing an instantiation of the SSBMO) of a sizable firm that is widely recognized for its attempts to become significantly less unsustainable, such as The Timberland Company, will give this research a significant additional data point about the utility of the SSBMO.
2. Have an example instantiation of the SSBMO, i.e. The Timberland Company's business model described using the SSBMO (K3-BM) could subsequently be used to help explain and validate the SSBMO during the 3rd Party Evaluation activities (E2).

Since the work to gather the publically available information about The Timberland Company had already been undertaken during a group course assignment (Drapeau et al., 2010), a familiarity with this firm's business model existed.

It was also clear that describing a real firm's business model using the SSBMO would give invaluable feedback on the utility of the SSBMO. At the same time, providing an example of the SSBMO in use would give the 3rd party experts something 'tangible' to react to help them give valid feedback on the utility of the SSBMO.

6.5.4.2 Assumptions

For the required evaluation activities the description of The Timberland Company's business model only has to have satisfactory accuracy; enough accuracy that it does not hinder the assessment of the utility of the SSBMO!

Hence, there is no attempt being made to assess the accuracy of the representation of The Timberland Company's actual business model. This is because:

- Only publically available, and hence incomplete, sources of knowledge have been used to construct the description of The Timberland Company business model using the SSBMO.
- None of the 3rd party experts being consulted have any direct personal knowledge of The Timberland Company.

6.5.4.3 Bias

The metrics to be gathered in this evaluation activity may be biased due to these factors: the researcher:

- Is conducting this analysis by constructing an instantiation of the SSBMO himself, without 3rd person review. (Of course the instantiation will subsequently be evaluated by the 3rd party experts in evaluation activity group E2b).
- Only has knowledge of The Timberland Company that comes from publically available sources (Drapeau et al., 2010).
- The format, layout and presentation of The Timberland Company business model described using the SSBMO can influence the range of possible feedback independent of the utility of the SSBMO.

6.5.4.4 Knowledge Sources – Consulted #1

Comparative analysis will be conducted using the public knowledge of The Timberland Company's business model (K3) to determine if there is a recognition, fit or likeness of the Timberland Company business model knowledge within the constructs and / or models of the designed artefact, i.e. the SSBMO design based on profit-first (K0-PF) and strongly-sustainable (K0-SS) key theoretical frames (Drapeau et al., 2010).

6.5.4.5 Knowledge Sources – Constructed and Subsequently Consulted

This comparative analysis will be conducted by attempting to document The Timberland Company's business model using the SSBMO and SSBMC, i.e. an example instantiation of the SSBMO and a summary using the SSBMC will attempt to be created containing a description of The Timberland Company's business model.

The output of the above comparative analysis is itself a knowledge source, labelled K3-BM. This knowledge source will be used in additional evaluation activities (within E1c and E2b):

6.5.4.6 Knowledge Sources – Consulted #2

Comparative analysis will be conducted using the CATWOE (K1) knowledge source to determine if there is a recognition, fit or likeness of the CATWOE knowledge within an example instantiation of the SSBMO (K3-BM).

6.5.4.7 Metrics

Values of the metrics shown in Table 6-32 are gathered by this evaluation activity sub-group:

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design
Completeness	**M4**: Completeness a) Related to reliability of SSBMO in describing business models, and b) The efficiency of business model designers in using the SSBMO to describe business models	Incompleteness
Completeness	**M5**: Level of detail satisfactory	To much or too little detail
Quality	**M8**: Internally Consistent	Internally Inconsistent
Generic	**M9**: Useful, has utility, to intended user	Not useful or produces adverse or unwanted effects

Table 6-32: Metrics Whose Values Are Being Gathered by E1c The Timberland Company Comparative Analysis Evaluation Activity

6.5.4.8 Evaluation Hypothesis

Considering the expectations / desirability matrix (Table 6-20) the following hypotheses were derived which will be confirmed or refuted during the execution of this sub-group of evaluation activities.

E1c-EH1: The SSBMO constructs and model fits well to The Timberland Company knowledge source. The Timberland Company has a reputation that suggests its stakeholder's world-view is somewhere in between the world-views used in the design of the SSBMO.

E1c-EH2: Once constructed, The Timberland Company business model expressed using the SSBMO fits well to the CATWOE knowledge source.

6.5.4.9 Execution Protocol

1. Review source documentation on The Timberland Company gathered during earlier group course assignment

2. Identify any gaps and/or revised sources of publically available information.

3. Track references of all sources used.

4. Iteratively build the business model for The Timberland Company (K3-BM) in a tabular / spreadsheet form (5.4.7) and a summary PowerPoint presentation. For each construct within the SSBMO use a table to identify and record examples (instances) of that construct identified from the publically available information. This involves identifying unique occurrences of the instances of a construct and the value of any attributes of that instance of the construct.

5. Periodically apply CATWOE knowledge (K1) framework to identify critical areas where the information sources incomplete and / or their interpretation may problematic. This review provides values of the metrics shown in Table 6-33.

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design
Completeness	**M4**: Completeness in regard to the efficiency of business model designers in using the SSBMO to describe firm's business models	Incompleteness
Generic	**M9**: Useful, has utility, to intended user	Not useful or produces adverse or unwanted effects

Table 6-33: Metric Values to Result from Comparing CATWOE (K1) Knowledge Source and The Timberland Company Business Model Described Using SSBMO (K3-BM)

6. Log any changes required to the SSBMO required to accurately record the instances of the constructs identified from the publically available information. The changes required provide values of the metrics shown in Table 6-34.

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design
Completeness	**M4**: Completeness related to the reliability of SSBMO in describing firm's business models	Incompleteness
Completeness	**M5**: Level of detail satisfactory	To much or too little detail
Quality	**M8**: Internally Consistent	Internally Inconsistent

Table 6-34: Metric Values to Result from Comparing Public Knowledge of The Timberland Company (K3) and the SSBMO constructs and model (K0-SS, K0-PF)

To prepare the business model example (K3-BM) for use in the 3rd Party Expert review (E2) the following steps are required:

7. Summarize the tabular form of the Timberland business model onto the SSBMC by applying sticky notes (5.4.8).
8. Reflect on experience of using the SSBMO to describe The Timberland Company business model and use this to validate / revised the questions to ask during the 3rd Party Expert group of evaluation activities (E2).

6.5.5 Updating Ontology Design Based on Evaluation Results

As described in Chapter 5 (Figure 5-1), following the completion of the comparative analysis group of evaluation activities (E1a thru c) the results of these evaluation activities, i.e. the values of the metrics gathered and the results of testing the above hypothesis will also be used to finalize the third iteration of the ontology design, the output of build activity (D3).

A log will be kept of the changes made to the 3rd iteration of the SSBMO based on the feedback generated by the evaluation activities. These changes are described in Chapter 8.

6.6 Evaluation Activity Group 2 – Third Party Review (E2)

This section describes in detail the research design created to undertake the group of evaluation activities in which feedback is gathered on the utility of the SSBMO design artefact from a range of expert third party reviewers against comparator sources of knowledge (K3-BM, K4, K5).

This work was completed between July 20, 2011 and February 28, 2013.

6.6.1 Gathering Informal Feedback (E2a)

6.6.1.1 Origins

The inspiration for gathering informal feedback to establish some initial level of confidence in the SSBMO research design and designed artefact came from a conversation with a faculty member of the University of Toronto Department of Computer Science on July 20, 2011.

In this discussion, the idea of presenting the current iteration of the SSBMO artefact and an overview of the research design to an information systems and sustainability seminar group was agreed.

This would present an opportunity to gather feedback while build activity D3 was underway.

6.6.1.2 Current Status

This seminar took place on August 9, 2011. The results are documented in Chapter 8.

6.6.1.3 Assumptions

This evaluation activity was intended to gather ‘simple’ ‘informal’ ‘face-value’ feedback, gathering values of the identified metrics in an opportunistic manner.

6.6.1.4 Bias

No warrants are made as to bias in this activity.

6.6.1.5 Knowledge Sources

The persons present at the seminar where assumed to have valid knowledge of business models (K4) and operating firms (K5) with which they could assess the fit or likeness of the SSBMO design based on profit-first (K0-PF) and strongly-sustainable (K0-SS) key theoretical frames.

6.6.1.6 Techniques

An informal discussion, an observational technique, was employed to gather the feedback.

6.6.1.7 Metrics

Values of the metrics shown in Table 6-35 are gathered by this evaluation activity sub-group.

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design
Completeness	**M4**: Completeness	Incompleteness
Completeness	**M5**: Level of detail satisfactory	To much or too little detail
Quality	**M6**: Comprehensibility	Incomprehensibility
Quality	**M7**: Real-world likeness to artefact	Artefact Unrepresentative of real-world

Table 6-35: Metrics Whose Values Are Being Gathered by E2a Informal 3rd Party Expert Review Evaluation Activity

6.6.1.8 Evaluation Hypothesis

No hypotheses were established prior to gathering this feedback. This idea was to remain open to any and all feedback from this exploratory feedback process.

6.6.1.9 Execution Protocol

1. Invitation sent to the seminar group. The announced title of the seminar was “Towards an Ontology for Strongly Sustainable Business: Challenges on a Work in Progress”. The presentation was billed as 120 minutes in total.

2. Made 60 minute presentation using Prezi, describing the SSBMO constructs and model (K0-SS, K0-PF)32.

3. A 120 minute informal discussion was moderated by the researcher. The majority of the attendees stayed for the extra discussion.

4. Subsequently values for the metrics based on the informal discussion were determined by the researcher.

5. The feedback and the interpreted values of the metrics in the evaluation results were documented. Ideas for improving the SSBMO which result from this analysis were also recorded for use during the completion of activity D3.

6. Ideas for the improvement of the research design were also documented.

6.6.1.10 Updating Ontology Design Based on Evaluation Results

As described in Chapter 5 (Figure 5-1), following the completion of the informal 3rd party expert review group of evaluation activities (E2a) the results of these activities are presented in Chapter 8.

The results of these evaluation activities, i.e. the values of the metrics gathered, were used to finalize the third iteration of the ontology design, the output of build activity (D3).

A log is kept of the changes made to the 3rd iteration of the SSBMO based on the feedback generated by the evaluation activities and these changes are described Chapter 8.

6.6.2 Introduction to Formal Expert Interviews (E2b)

6.6.2.1 Origins

The inspiration to consider an evaluation activity using the knowledge of 3rd party experts with a range of world-views, but (largely) independent of the strongly sustainable key theoretical frames (K0-SS) used during build activities (D1 thru D3), came during a conversation with Prof. David. Johnston on July 19, 2011.

[32] During additional opportunities to informally gather 3rd party expert feedback (8.3, 8.6.2.3) an instantiation of the SSBMO using the SSBMC (5.4.8), describing The Timberland Company business model (K3-BM, prepared during E1c) was also shown.

6.6.2.2 Assumptions

The following assumptions are being made related to this evaluation activity group:

- The knowledge of the selected experts is valid and they have the time, desire and ability to contribute to this research.
- Meaningful feedback can be given after a limited exposure to the SSBMO design artefact and an example of an instantiation of the SSBMO.
- There will be no difference between the feedback provided based on the experts':
  - 'Personal' world-view, and
  - Attempts to represent the view of the organizational(s) with which they are affiliated.

6.6.2.3 Bias

The following potential sources of bias that could influence the capture and values of the metrics to be gathered in this evaluation activity, were identified:

- The researcher has a range of levels of personal relationships with the selected experts. However, with two exceptions, no time has been spent with them either building a deep relationship, nor discussing my research prior to undertaking the evaluation activities.
- The format, layout and presentation of The Timberland Company business model described using the SSBMO and SSBMC can influence the feedback offered independent of the utility of the SSBMO.

6.6.2.4 Knowledge Sources / Respondents

The comparison knowledge source for this evaluation activity group are the experts' knowledge of business models (K4) and operating firms (K5). The process of selecting (sampling) the experts was based on:

1. Who was an existing member of my professional network

2. Their level of knowledge and expertise about business models (K4).
3. The range of knowledge of operating firms in various industry sectors (K5).
4. The likely range of world-views of these individuals.

Due to perceived gaps in the range of world-views represented in the researcher's professional network[33], the researcher undertook efforts to add members to his network for this specific evaluation activity.

This process led to the identification of the seven 3rd party experts to be consulted in this group of evaluation activities. Basic demographic information about these experts used to control cohort validity / variety is presented in Table 6-36.

Respondent ID	**Expected World-view** (1 = aggressively profit first, 4 = Neutral, 7 = aggressively strongly sustainable)	**Industry**
E2b-1	6	Education
E2b-2	6	Sustainable Business NGO / Multiple
E2b-3	5-6	Consulting / Multiple
E2b-4	5	Nature NGO / Multiple
E2b-5	4	Consulting / Multiple
E2b-6	2-3	Education / Multiple
E2b-7	2-3	Consulting / Multiple

Table 6-36: Expert Interviewee Basic Demographic Information (Expected)

The two knowledge sources these experts possess will be compared to the designed artefact as shown in Table 6-37.

[33] The members of the researcher's network were very predominantly biased towards the profit-first world-view.

Comparison Knowledge Source	Designed Artefact
Knowledge and expertise about business models (K4)	SSBMO constructs and model (K0-PF and K0-SS)
Operating firms in various industry sectors (K5)	Example instantiation of SSBMO, the business model of The Timberland Company described using the SSBMO and SSBMC developed in evaluation activity group E1c (K3-BM)

Table 6-37: Comparison Knowledge Source and Design Artefact to be used in Evaluation Activity E2b Formal Expert Interviews

6.6.2.5 Techniques

Interviews

The observations are gathered in a semi-structured interview setting using a topical, rather than specific, set of items.

This is to try to ensure responses are solicited consistently, while giving an opportunity for each interviewee to use their unique, knowledge, expertise, and perspective to provide their feedback.

Interviews are recorded and transcribed. Notes are taken by the interviewer during the interview and my reflections about the interview are documented immediately following the end of the interview.

However, since the experts have limited knowledge of the SSBMO artefact, a briefing is held to describe the SSBMO, and time given for reflection, before these interviews are undertaken. Both the SSBMO artefact (constructs and model) and an example instantiation (The Timberland Company business model K3-BM) is shared in this briefing.

Analysis

The purpose of the analysis of the interview transcripts and notes is to:

- Interpret values of the metrics being measured.
- Generate ideas for improvement to the designed artefact (i.e. the proposed changes are designed to increase the values of the metrics in a subsequent evaluation, outside the scope of this research).

The work required to meet these objectives is a considerably simpler analytical activity than is typical of qualitative interview transcripts and notes (e.g. generating grounded theory from observation).

As described in 6.2.3.3, no code book development or use is required. Rather the designed artefact (constructs and model), the evaluation metrics and the researcher's knowledge and intuition can be used to achieve the above objectives.

The ability to undertake this analysis rigorously and with a known level of bias is a key reason for the extensive preparation undertaken for the evaluation activities as recorded in this document.

6.6.2.6 Metrics

Values of the metrics shown in Table 6-38 are gathered by this evaluation activity sub-group.

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design
Completeness	**M4**: Completeness a) Related to reliability of SSBMO in describing business models in general b) The efficiency of business model designers in using the SSBMO to describe business models	Incompleteness
Completeness	**M5**: Level of detail satisfactory	To much or too little detail
Quality	**M6**: Comprehensibility a) Related to reliability of SSBMO in describing business models in general b) The efficiency of business model designers in using the SSBMO to describe business models	Incomprehensibility
Quality	**M7**: Real-world likeness to artefact	Artefact unrepresentative of real-world
Generic	**M9**: Useful, has utility, to intended user	Not useful or produces adverse or unwanted effects
Beauty	**M10**: Elegance	Inelegant
Quality	**M11**: Easy to Use	Hard to Use

Table 6-38: Metrics Whose Values Are Being Gathered by E2b Formal Expert Interviews Evaluation Activity (Overall)

6.6.2.7 Evaluation Hypothesis

Considering the expectations / desirability matrix (Table 6-20) the following hypotheses were derived which will be confirmed or refuted during the execution of this sub-group of evaluation activities.

E2b-EH1: Experts who have a profit-first world-view will tend to give less enthusiastic positive feedback than the experts who have strongly-sustainable world-views. This will include the profit-first experts deeming changes / additions to the BMO as unnecessary, adding complication for no reason, etc.

6.6.3 Execution Protocol for Formal Expert Interviews (E2b-1 thru 7)

6.6.3.1 Execution Protocol

1. Discuss possibility of participating in this research project with potential interviewees. This included sharing enough information about the research project objective, designed artefact, etc. to establish credibility. This execution protocol is also summarized and shared with the potential interviewees.

2. Assemble a cohort of experts with appropriate demographics (Table 6-36) using process described in 6.6.2

3. Send Informed Consent form to interviewees.

4. Collect signed informed consent form from interviewees.

5. Conduct formal briefing on the SSBMO with interviewees.

    - Includes presenting both the SSBMO constructs and model (K0-SS, K0-PF), and The Timberland Company business model (K3-BM, prepared during E1c) as an example of an instantiation of the SSBMO using the SSBMC (5.4.8).

    - Provide copies of materials presented.

    - No feedback will be formally requested or recorded at these briefings. The fact that this is an unusual request (from a normal business perspective) will be noted in the preamble to this session. Experts will be asked to note their questions and provide them as feedback during the semi-structured interviews.

- Provide the items to be asked during the subsequent semi-structured feedback interview, with the request that the experts consider their responses prior to the interview.
- Duration: 1 hour
- Format: face-to-face (preferably) or electronically (Skype).

6. Leave time for interviewee to reflect on the fit of their knowledge (K4, K5) with the SSBMO and their responses to the semi-structured interview items (ideally 24-48 hours).
7. Conduct semi-structured feedback interview where items will be formally presented to gather feedback on various aspects of the utility of the SSBMO.
    - See below 6.6.3.2-6.6.3.5 below for topics to be covered in order to gather the data to interpret values of the metrics to be measured.
    - Interview will be recorded.
    - Notes will be taken during the interview.
    - The researcher's reflections about the interview will be recorded immediately following the interview and added to as the researcher reflects on the feedback received.
    - Duration: 90 minutes
    - Format: face-to-face (preferably) or electronically (Skype).
8. Transcribe interview.
9. Analyze transcript, and the notes taken to interpret and record values of the metrics and ideas for improving the he SSBMO which result from this analysis.
10. Once all interviews are completed and analyzed, review and analyze the individual interview analysis to identify additional feedback. This 2nd level of feedback may

- ‘Increase’ or ‘decrease’ the interpreted values of the metrics.
- Identify contradictions or other patterns in the feedback amongst the interviewees.
- Help identify additional ideas for improving the SSBMO.

11. Once thesis is complete send copy to interviewees, if requested, with an offer to respond to any follow-up questions.

6.6.3.2 Items to Validate Demographics of Interviewee

Background

Approximately 10 minutes of the time in the interview will be used to gather feedback on these topics.

These items will be given to the interviewee at the end of the briefing presentation, with the request that they consider their responses prior to the start of this interview.

Items to Validate Demographics of Interviewees

The questions shown in Table 6-39 will be used to validate the interviews knowledge about businesses models (K4) and operating firms / organizations (K5).

Item # E2b-Q-DG	Item	Knowledge Source Validation
1.	Please state your name, your title / position, employer and/or other affiliations	N/A
2.	Please state the industry sector of your employer and any other industry sector in which you would describe your level of knowledge as very good or expert.	K5
3.	Please identify your level of knowledge about specific firms who operate in the industry sector(s) you identified above. Please consider how much you know about these specific firms customers / markets, value propositions, business processes (operations / supply chain), and their results (scale 1-7 – 1 = knowledge of most aspects of one to three firms, 7 = deep knowledge all aspects of ten or more firms)	K5
4.	How important to successfully creating or changing a business is designing the future business model of that organization (scale 1-7 – 1 = always unimportant, 4 = can be important, 7 = always very important)?	K4 & K5
5.	Please identify your level of knowledge of the process of designing business models (scale – 1-7 – 1 = no expertise, 4 = some experience of designing business models, 6 = highly proficient, design business models regularly as part of my work, 7 = I helped to write a textbook on business model design).	K4
6.	Please identify your level of knowledge of the content that a "best practice" business model should contain (scale – 1-7 – 1 = no knowledge, 4 = some knowledge, 7 = complete knowledge, I helped to write a text book on business models)	K4
7.	Do you use formalisms (methods, tools – manual or computerized) to help you design business models? If yes, please list the formalisms you use.	K4
8.	Please identify your world-view using the scale described in the briefing presentation - "strongly-sustainable" to "profit-first" (scale of 1-7 – 1 = aggressively profit first, 4 = Neutral, 7 = aggressively strongly sustainable)	K4 & K5

Table 6-39: Items to Validate Demographics of Interviewees (E2b)

6.6.3.3 Items / Topics / Metrics to Assess Fit of Expert Knowledge of Business Models (K4) to SSBMO (K0-PF, K0-SS)

Background

Approximately two-thirds of the time in the interview will be used to gather feedback on these questions / topics.

These items will be given to the interviewee at the end of the briefing presentation.

Metrics

These items will gather feedback to be used subsequently to interpret values of the metrics shown in Table 6-40.

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design
Completeness	**M4**: Completeness: Related to reliability of SSBMO in describing business models in general	Incompleteness
Completeness	**M5**: Level of detail satisfactory	To much or too little detail
Quality	**M6**: Comprehensibility: Related to reliability of SSBMO in describing business models in general	Incomprehensibility
Quality	**M7**: Real-world likeness to artefact	Artefact unrepresentative of real-world
Generic	**M9**: Useful, has utility, to intended user: Related to the effectiveness of SSBMO in creating business models	Not useful or produces adverse or unwanted effects
Beauty	**M9**: Elegance	Inelegant

Table 6-40: Metrics Whose Values Are Being Gathered by E2b Formal Expert Interviews Evaluation Activity (Fit of K4 to SSBMO)

Items to Gather Feedback on SSBMO

The questions shown in Table 6-41 assume the interviewees will answer based on their own process of comparing their knowledge of business models (K4) to the SSBMO (K0-PF, K0-SS).

The following preamble will be given prior to asking these items:

> *The purpose of gathering this feedback is to:*
>
> - *Improve the SSBMO, to make it more useful*
> - *Determine where you believe the SSBMO is already useful*
>
> *When responding to the following please consider how well (if at all) your knowledge of business models – their purpose, components, and the process of using them in organizations – fits with, is recognized within, or has a likeness to the SSBMO (presented in the briefing presentation).*
>
> *Please be as direct and straight forward as possible in your responses.*

Item # E2b-Q-FO	**Item**	**Metric**
1.	In your opinion are there any constructs (boxes) in the SSBMO whose meaning or purposes are unclear to you? If so, which aspects? Why?	M6: Comprehensibility / Incomprehensibility
2.	In your opinion are there any relationships (lines) in the SSBMO whose meaning or purposes are unclear to you? If so, which aspects? Why	M6: Comprehensibility / Incomprehensibility
3.	In your opinion, to fully describe a business model, are there any constructs (boxes) missing from the SSBMO? If so, which constructs are missing (boxes)? Why should they be added?	M4: Completeness / Incompleteness

Item # E2b-Q-FO	**Item**	**Metric**
4.	In your opinion, to fully describe a business model, are their any relationships (lines) between the constructs (boxes) which you would want to represent but that as missing from the SSBMO? If so, which relationships are missing (lines)? Why should they be added?	M4: Completeness / Incompleteness
5.	In your opinion to fully describe a business model, are there any relationships (lines) or constructs (boxes) shown on the SSBMO which you believe are unnecessary? If so, which ones can be removed and why?	M5: Level of detail satisfactory / To much or too little detail
6.	Do you believe that using the SSBMO to describe a business's business model would result in an accurate description of that business model? If yes, why? If not, why not?	M7: Real-world likeness to artefact / Artefact unrepresentative of real-world
7.	All other things considered, do you believe the use of the SSBMO to design strongly sustainable business models could make those models better, i.e. more likely to result in successful businesses? If yes or no, why?	M9: Useful, has utility, to intended user / Not useful or produces adverse or unwanted effects
8.	Do you consider the SSBMO to be an elegant or inelegant tool for strongly sustainable business model designers? Why?	M10: Elegant / Inelegant

Table 6-41: Items to Assess Fit of Expert Knowledge of Business Models (K4) to SSBMO (K0-PF, K0-SS)

6.6.3.4 Items / Topics / Metrics to Assess Expert Knowledge of Operating Firms (K5) to SSBMO Example Instantiation (K3-BM)

Background

Approximately one-third of the time in the interview will be used to gather feedback on these questions / topics. These items will be given to the interviewee at the end of the briefing presentation.

Metrics

These items will gather feedback to be used subsequently to interpret values of the metrics shown in Table 6-42.

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design
Completeness	**M4**: Completeness: The efficiency of business model designers in using the SSBMO to describe business models	Incompleteness
Completeness	**M5:** Level of detail satisfactory	To much or too little detail
Quality	**M6**: Comprehensibility a) Related to reliability of SSBMO in describing business models in general b) The efficiency of business model designers in using the SSBMO to describe business models	Incomprehensibility
Quality	**M7**: Real-world likeness to artefact	Artefact unrepresentative of real-world
Generic	**M9**: Useful, has utility, to intended user: Related to the effectiveness of SSBMO in creating business models	Not useful or produces adverse or unwanted effects
Beauty	**M10**: Elegance	Inelegant
Quality	**M11:** Easy to Use	Hard to Use

Table 6-42: Metrics Whose Values Are Being Gathered by E2b Formal Expert Interviews Evaluation Activity (Fit of K5 to SSBMO Example Instantiation K4-BM)

Items to Gather Feedback on Example Instantiation of SSBMO

The items shown in Table 6-43 assume the interviewee will respond based on their own process of comparing their knowledge of operating businesses / organizations (K5) and business models (K4) to the example instantiation of the SSBMO (K3-BM), The Timberland Company business model described using the SSBMO and SSBMC.

Caveats

As noted earlier these questions are not intending to:

1. Assess the accuracy of the example business model, since this would give feedback on the quality and completeness of the publically available information on The Timberland Company or my expertise in describing this information using the SSBMO.
2. Assess the format or layout of the example business model.

The following preamble will be given prior to asking these items:

> *When responding to the following items please consider how well (if at all) your knowledge of actual operating businesses – customers / markets, value propositions, business processes (operations / supply chain), and the results – business models – fits with, is recognized within, or has a likeness to the example business model of The Timberland Company provided (presented in the briefing presentation).”*

Item # E2b-Q-FI	**Item**	**Metrics**
1.	In your experience is the level of detail presented about The Timberland Company appropriate? Why? If not, what needs to be added or removed?	M5: Level of detail satisfactory / To much or too little detail
2.	Are there any aspects of The Timberland Company business model which are unclear to you? Which aspects? Why?	M6: Comprehensibility / Incomprehensibility related to reliability (may also get feedback on accuracy of the example instantiation)
3.	In your opinion, if you were describing The Timberland Company business model to a colleague would using this example of The Timberland Company's business model improve your success? Why? Why Not?	M6: Comprehensibility / incomprehensibility related to efficiency M5: Level of detail satisfactory / To much or too little detail (may also get feedback on the layout / format of the example)
4.	From your knowledge of businesses and their business models, how representative of The Timberland Company do you believe this description of The Timberland Company business model is? Why? If anything: what would make this description more representative? What should be removed because it is irrelevant?	M4: Completeness / Incompleteness M7: Real-world likeness to artefact / Artefact unrepresentative of real-world
5.	In your opinion is this an elegant or inelegant description of The Timberland Company's business model? Why?	M10: Elegant / Inelegant

Item # E2b-Q-FI	**Item**	**Metrics**
6.	Is it meaningful / useful to you to think of The Timberland Company's business model: a. As described using the SSBMO b. In the terminology used by the SSBMO (the names of the constructs/boxes, and relationships/lines)? If yes, how is it meaningful / useful? If no, why not?	M6: Comprehensibility / Incomprehensibility related to efficiency
7.	Given businesses are complex: do you believe the SSBMO would be easy or hard to use to design a new or redesign an existing business model? Why?	M9: Useful, has utility, to intended user / Not useful or produces adverse or unwanted effects
8.	a. Do you believe the SSBMO would be useful to people designing business models based on their interpretation of "profit-first" or "strong-sustainability". Why? Why not? b. Do you believe the SSBMO would be useful to people designing changes to a business (introducing new products, improving operations, etc.), or identifying and resolving problems in businesses? Why? Why not? Would you use it for this purpose?	M8: Completeness / Incompleteness M9: Useful, has utility, to intended user / Not useful or produces adverse or unwanted effects
9.	Having seen both the structure of the SSBMO and an example of the SSBMO in use, do you think that using the SSBMO would increase the efficiency* of business model designers? * Efficiency = faster to produce, less rework, lower risk of subsequent implementation failure, etc. Why? Which groups would find it useful (managers, consultants, academics, or others – please specify) What would need to be added / removed to change your assessment?	M11: Easy to use / Hard to us M6: Comprehensibility / Incomprehensibility related to efficiency

Table 6-43: Assess Expert Knowledge of Operating Firms (K5) to SSBMO Example Instantiation (K3-BM)

6.6.3.5 Closing Items to Gather Addition Feedback

The interview will be closed with the items shown in Table 6-44.

Item # E2b-Q-C	**Items**	**Metrics**
1.	Do you have any final comments on the SSBMO?	Mx: Any, All, Metrics not considered
2.	Would you like to learn more about the SSBMO?	M9: Overall measure of Utility (may also measure fit of idea of business model with interviewees role)
3.	Do you have any comments about this interview or this research project?	Mx: Any, All, Feedback on the research process
4.	Thank-you for your time and feedback. I will send you a copy of the transcript to review to confirm its accuracy. I will send you a copy of a summary of the feedback you a have provided to confirm the accuracy of my analysis Would you like to receive a copy of my final thesis once it is completed?	

Table 6-44: Items to Close Expert Feedback Interviews

6.7 Evaluation Activity Group 3 – Case Studies (E3)

This section describes in detail the research design created to undertake the group of evaluation activities which gathered feedback on the utility of the SSBMO design artefact using three case studies as comparator sources of knowledge (K6-E, K6-D, K6-BM).

This work was completed between February 1, 2012 and February 28, 2013.

6.7.1 Introduction to Case Studies

6.7.1.1 Origins

The inspiration to consider an evaluation activity using knowledge from a number of cases came during conversations with Prof. David Johnston between December 2010 and February 2011. These discussions included the idea of identifying cases of firms with a range of attempts at designing and implementing business models based on a range of world-views on sustainability.

Subsequently in developing a relationship with the senior project manager of a local industrial ecology project, it became apparent that firms in the eco-business zones could be a source for the desired cases. However, it became clear that all the firms in the industrial ecology project, even those taking a proactive stance towards sustainability issues, had a world-view that was closer to profit-first than strong sustainability. The best of these firms was 'only' trying to become significantly less unsustainable.

Later, a connection was made with the CEO of one of the first Certified B Corp manufacturers in Ontario (a company I was already familiar with and whose manufacturing plant outlet store had been visited several times). As a Certified B Corp corporation (scoring 124.5 / 200) this organization's business model was clearly closer to the strongly-sustainable world-view than profit-first.

6.7.1.2 Assumptions

The following assumptions are being made related to this evaluation activity group:

- The knowledge of the selected employees is valid and they have the time, desire and ability to contribute to this research.
- The world-view of the firm required by the research design (see Knowledge Sources – Selecting Cases below) matches the actual world-view of the firm.
  - The SSBMO constructs and model are not being shared with the case firm employees (only a specific instantiation of the SSBMO).

  - This is important to be able to get a triangulation on the expert's view of an example instantiation of the SSBMO. The case firm employees are sources that have not been biased by an understanding of the 'theory' of the instantiation they will review.

- Meaningful feedback can be given after a limited exposure to the specific instantiation of the SSBMO.

- No meaningful feedback can be obtained concerning the potential utility of the SSBMO directly, as these employees have not been selected based on their expertise in the concepts or use of business models or business model design tools.

- There will be no difference between the feedback provided based on the employees:

  - 'Personal' world-view, and

  - Attempts to represent the view of the organization they are employed by.

It should be noted that none of the employees / firms who were approached by the researcher to participate in the research declined.

As for The Timberland Company (K3-BM, and as noted in section 6.5.4.2), it is assumed that the accuracy of description of the business models of the case companies is not being tested. The description of the case company's business model only has to have satisfactory accuracy; enough accuracy that it does not hinder the assessment of the utility of the SSBMO by the case companies employees!

6.7.1.3 Bias

The metrics to be gathered in this evaluation activity may be biased due to these factors:

- The amount of information in a typical business model, coupled with lack of a computerized tool for the creation of example SSBMO instantiations, limits the amount of detail that can be captured and managed.

- The format, layout and presentation of the case company's business model described using the SSBMO and SSBMC can influence the range of possible feedback independent of the utility of the SSBMO.
- The CATWOE evaluation is subject to the same biases as evaluation activity sub-group E1c Timberland.

6.7.1.4 Knowledge Sources and Execution Protocol – An Introduction

The case study is conducted, using the following knowledge sources, in this manner:

1. Employees are interviewed to gather their knowledge about the case firm's business model (K6-E1 thru 3)
2. Other documentation are gathered and reviewed to gain additional knowledge about the case firm's business model (K6-D1 thru 3).
3. This knowledge are described by the researcher using the SSBMO, creating instantiations of the SSBMO: business models of the case firms described using the SSBMO (tabular / spreadsheet form, 5.4.7) and SSBMC (sticky notes, 5.4.8) (K6-BM1 thru 3).
4. The CATWOE (K1) knowledge source are used to evaluate the completeness of case firm's business model descriptions (K6-BM1 thru 3)
5. The researcher presents the final version of each firm's business model, described using the SSBMO (K6-BM1 thru 3), to the employee of that firm.
6. The employee are then be asked to use their knowledge (K6-E1 thru 3) to determine if there is recognition, fit or likeness of their employer's business model to the description of that model described using the SSBMO (K6-BM1 thru 3). A semi-structured interview with the employee will be used to gather their reflection on this activity for subsequent analysis.

6.7.1.5 Knowledge Sources – Selecting Cases

The comparison knowledge sources for this evaluation activity group are employees (K6-E) and documentation about the case firms (K6-D) provided by those employees.

The process of selecting (sampling) which cases was based on:

1. Which firms were known to the senior project manager of the industrial ecology project.
2. How the senior project manager assessed the fit of these firms to the selection categories (see below)
3. Other firms known to the researcher and their fit to the selection categories (see below).

This process led to the identification of a short-list of firms by category. In order to gain feedback from a variety of world-views from profit-first to strongly sustainability (both in principle and practice) the following categories were used to select the three cases:

E3a **_Achieving (K6-E1, K6-D1)_**: A case in which the firm believes in some form of strong sustainability, and is demonstrating its belief through the achievement of strong sustainability outcomes. This will confirm the SSBMO's utility to describe business models of firms who are strongly sustainable.

E3b **_Committed (K6-E2, K6-D2)_**: A case in which the firm believes in some form of sustainability as a mostly secondary objective, after making a reasonable monetary profit, and is demonstrating commitment to this secondary objective through the undertaking of projects to achieve improvement in sustainability outcomes. This will confirm the SSBMO's utility to describe firms whose business model is based on a world-view between strongly sustainable and profit-first.

E3c **_Interested (K6-E3, K6-D3)_**: A case in which the firm believes in making monetary profit, and while interested in learning more about sustainability has yet to make a firm commitment to taking action. This will confirm the SSBMO's utility to describe firms whose business models are based on the profit-firms world view, i.e. that the changes make to Osterwalder's BMO to arrive at the design of the SSBMO have not hindered the SSBMO's utility at describing the profit first world-view.

Basic demographic information about the selected firms used to control cohort validity / variety is presented in Table 6-45.

Case ID	**Position**	**Level of Interest of Firm in Sustainability**	**World-view** (1 = aggressively profit first, 4 = Neutral, 7 = aggressively strongly sustainable)	**Industry**
E3a	Owner and Founder, Board Member, Former CEO	Achieving Results, Certified Benefit Corporation	6-7	Discrete Manufacturing: Food Processing – Diary products.
E3b	Owner, Chief Technology Officer	Active sustainability program underway, some results achieved	3-4	Discrete Electrical Power Conditioning Equipment Manufacturer and Power Consumption Software Systems Development
E3c	TBD	Interested - Looking to make changes to improve sustainability, but in the early planning / experimentation phase	Target range 1-3	TBD

Table 6-45: Case Study Firm Basic Demographic Information (Expected)

6.7.1.6 Knowledge Sources – Constructed and Subsequently Consulted

The knowledge gained from the cases (K6-E, K6-D) will be used to create the knowledge sources to be used in the final step of this evaluation activity group: descriptions of the case company's business model using the SSBMO (K6-BM1 thru 3), i.e. specific instantiation of the SSBMO will be created containing a description of each case company's business model.

These knowledge sources will be labelled K6-BM1 thru 3.

Subsequently, following a briefing on the case firm's business model (K6-BM1 thru 3), semi-structured interviews will be conducted. During this interview the employee will be asked to use their knowledge (K6-E1 thru 3) to determine if there is recognition, fit or likeness of their employer's business model to the description of that model described using the SSBMO (K6-BM1 thru 3), i.e. do the employees of the case firm recognize their business model when it is presented to them using the SSBMO and is this perspective on their business model useful to them.

6.7.1.7 Knowledge Sources – Consulted #2

Comparative analysis using the CATWOE (K1) knowledge source to determine if there is recognition, fit or likeness of the CATWOE knowledge within an initial version of the description of the case firm's business models (K6-BM1 thru 3). This analysis will generate feedback:

- Along the same lines as evaluation activity group E1c The Timberland Company.
- On the completeness of the description of the case firm's business model, and hence this description is ready to used in the subsequent steps of this evaluation activity group.

6.7.1.8 Metrics

Values of the metrics shown in Table 6-46 are gathered by this evaluation activity group.

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design
Generic	**M9**: Useful, has utility, to intended user	Not useful or produces adverse or unwanted effects
Beauty	**M10**: Elegance	Inelegant
Completeness	**M4**: Completeness the efficiency of business model designers in using the SSBMO to describe business models	Incompleteness
Quality	**M6**: Comprehensibility: the efficiency of business model designers in using the SSBMO to describe business models	Incomprehensibility
Quality	**M11**: Easy to Use	Hard to Use

Table 6-46: Metrics Whose Values Are Being Gathered by E3 Case Studies Evaluation Activity

6.7.1.9 Evaluation Hypothesis

Considering the expectations / desirability matrix (Table 6-20) the following hypotheses were derived which will be confirmed or refuted during the execution of this sub-group of evaluation activities.

E3-EH1: Employees of firm's who have a profit-first world-view will tend to give less enthusiastic positive feedback than the employees of firm's who have strongly-sustainable world-views. This will include the profit-first employees deeming constructs and relationships added to the BMO as unnecessary, adding complication for no reason, etc.

6.7.2 Execution Protocol for Case Studies (E3)

6.7.2.1 Execution Protocol

1. Discuss possibility of participating in this research project with potential case employees. This included sharing enough information about the research project

objective, designed artefact, etc. to establish credibility. This execution protocol is summarized and shared with the potential interviews

2. Assemble a cohort of cases with appropriate demographics (see above) using process described in section 6.7.1.5.
3. Send Informed Consent form to interviewees.
4. Collect signed informed consent form from interviewees
5. Gather data about case firm's business model. This will be done in two steps:
    1. A list of documents (see below 6.7.2.2) that typically contain information about the firm's business model will be given to the employees with a request to provide as many of these documents, or suitable alternatives, as possible.
        - The documents will be collected in whatever format they are available and become the knowledge source K6-D1 thru 3 for each case respectively.
        - A request will be made to provide the documents prior to the next step, the data collection interview.
    2. A data collection interview with each case employee.
        - See 6.7.2.4 below for topics to be covered (items to be asked) to gather / confirm information about the case firm's business model
        - Interview will be recorded
        - Notes will be taken during the interview.
        - Reflections about the interview will be recorded immediately following the interview and added to as the researcher reflects on the feedback received.
        - Duration: 90 minutes
        - Format: face-to-face (preferably) or electronically (Skype).

6. Document case firm's business model using SSBMO and SSBMC to create K6-BM1 thru 3 (using the process described in 5.4.7, 5.4.8 respectively). This uses the same processes to construct the description of the Timberland Company business model using the SSBMO and SSBMC (evaluation activity sub-group E1c, 6.5.4.9)

7. Periodically apply CATWOE knowledge (K1) source and technique to identify critical areas where the information sources are incomplete and / or their interpretation may problematic.

   - These reviews provide values of the metrics shown in Table 6-47.

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design
Generic	**M9**: Useful, has utility, to intended user	Not useful or produces adverse or unwanted effects
Completeness	**M4**: Completeness in regard to the efficiency of business model designers in using the SSBMO to describe firm's business models	Incompleteness

Table 6-47: Metric Values Resulting from Comparing CATWOE (K1) Knowledge Source and Case Business Model Described Using SSBMO (K6-BM1 thru 3)

   - Log any changes required to the SSBMO required to accurately record the instances and relationships of the constructs identified from the knowledge (K6-E1 thru 3 and K6-D1 thru 3) about each case company's business model (K6-BM1 thru 3).

8. Provides a formal briefing to the case firms employee of that firm's business model described using the SSBMO (K6-BM1 thru 3)

- Includes presenting the case study firm's business model (K6-BM1 thru 3) as an specific instantiation of the SSBMO in tabular form (5.4.7), and using the SSBMC (5.4.8).
- Provide copies of materials presented.
- No feedback will be formally requested or recorded at these briefings. The fact that this is an unusual request (from a normal business perspective) will be noted in the preamble to this session. Employees will be asked to note their feedback and provide them as feedback in the semi-structured interviews.
- Provide the items to be asked during the subsequent semi-structured feedback interview, with the request that the employees consider their answers prior to the interview.
- Duration: 1 hour
- Format: face-to-face (preferably) or electronically (Skype).

9. Leave time for interviewee to reflect on the fit of their knowledge (K6-E1 thru 3) with the specific instantiation of the SSBMO (K6-BM1 thru 3) (ideally 24-48 hours).
10. Conduct semi-structured feedback interview where items will be presented to gather feedback on various aspects of the utility of the SSBMO.
    - See 6.7.2.5 below for topics to be covered (items to be asked) in order to gather the data to interpret values of the metrics to be measured.
    - Interview will be recorded.
    - Notes will be taken during the interview.
    - Reflections about the interview will be recorded immediately following the interview and added to as the researcher reflects on the feedback received.
    - Duration: 60 minutes
    - Format: face-to-face (preferably) or electronically (Skype).

11. Transcribe interview.
12. Analyze transcript, and the notes taken to interpret and record values of the metrics and ideas for improving the he SSBMO which result from this analysis.
13. Once all interviews are completed and analyzed, review and analyze the individual interview analysis to identify additional feedback. This 2nd level of feedback may
    - "Increase" or "decrease" the interpreted values of the metrics.
    - Identify contradictions or other patterns in the feedback.
    - Help identify additional ideas for improving the he SSBMO.
14. Once thesis is complete send copy to interviewees, if requested, with an offer to respond to any follow-up questions.

6.7.2.2 List of Documents Typically Containing Information Relevant to Firm's Business Models (K6-D1 thru 3)

Table 6-48 shows a list of documents or their equivalent that will be sought from each case company to enable their business model to be documented using the SSBMO (tabular form) and SSBMC (sticky notes).

1. Business strategy / plan including mission / vision statement - in report or presentation format - perhaps contained in literature designed for employees, customers, suppliers, partners Recent annual report or summary presentation (perhaps for the Board of Directors [BOD])
2. GRI report or presentation (or any other internal measurement or external reporting of environmental / social goals and results)
3. B-Impact Assessment survey and any presentations, or reports from this process (or any other NGO audit of your operation)
4. Environmental policy and plan
5. Social policy and plan (including. issues of locality, distributional equity, etc.)
6. Purchasing policy and plan (including identification of strategic supplier or retail

partnerships, outsourcing arrangements etc.)

7. Human resource policy, manual and plan (ethics, hiring, termination, job sharing, pension, benefits, employee share ownership, etc.)
8. Investor policy (who can own shares)
9. Governance structure (e.g. who decides what, BOD and its sub-committees, transparency, external directors)
10. Marketing plan (e.g. identification of target customers, value propositions, channel strategy, relationship strategy)
11. Internal or external audit reports, or any internal management plans, presentations, reviews or reports on any or all of the following topics
    a. Supplier assessments
    b. Carbon inventory
    c. Energy conservation/efficiency audit
    d. Product / service life cycle assessment - including plans for re-manufacturability; closed-loop product design, etc.
    e. Raw materials toxicity,
    f. Manufacturing waste toxicity [solid, liquid, gases],
    g. Packaging
    h. Water use
    i. Financial / operations internal-audit
12. Documentation from ISO9000, ISO14000, ISO26000, ISO50000 audits / reviews

Table 6-48: List of Documents Typically Containing Information Relevant to Firm's Business Models

6.7.2.3 Items to Gain Demographic Information about Case Firms

The items shown in Table 6-49 are be used to gain demographic information about the case firms and the knowledge of their employees (K6-E1 thru 3).

<table>
<tr><th>Item #
E3-Q-DG</th><th>Item</th></tr>
<tr><td>1.</td><td>Please state your name, your title / position, and role within the firm</td></tr>
<tr><td>2.</td><td>Please state the industry sector of your employer</td></tr>
<tr><td>3.</td><td>Please state your understanding of the term “business model”.</td></tr>
<tr><td>4.</td><td>How does the term “business model” relate to your firm or your role?</td></tr>
<tr><td>5.</td><td>In your option how important to successfully creating a new product or service, or changing an existing part of your business, is thinking through (conceiving, designing, planning) all the elements of the project? (scale 1-7 – 1 = always unimportant, 4 = can be important, 7 = always very important)?</td></tr>
<tr><td>6.</td><td>How involved are you in thinking through (conceiving, designing, planning) the creation of a new product or service, or changing an existing part of your business? (scale 1-7 – 1 = never involved, 4 = involved in some small initiatives, 7 = involved in all large initiatives)</td></tr>
<tr><td>7.</td><td>Some people passionately believe that the purpose of a business is to make as much financial profit as possible, as quickly as possible, using any legal means.

Some people passionately believe that the purpose of a business is to achieve a balance of positive outcomes in society, the environment and the economy, while proactively minimizing any social, environmental or monetary harm.

Using these two passionately held positions as the ends of a 7 point scale, how would you:
a. Rate your personal perspective?
b. Rate your firm’s current perspective – i.e. based on how the business operates today
c. Rate your firm’s perspective 5 years ago – i.e. based on how you operated then
d. Rate your firm’s desired future perspective, based on how you have already planned to operate if this is different from the current perspective.</td></tr>
</table>

Table 6-49: Items to Gather Demographics of Case Firm Employees (E3)

6.7.2.4 Items / Topics / Metrics to Gather Case Information (K6-E1 thru 3)

Once the documentary knowledge is reviewed (K6-D1 thru 3), the list of items shown in Table 6-50 will be adapted based on assessed gaps or contradictions in the knowledge required to describe the case firm's business model.

These revised items will be used to triangulate the documentary knowledge (K6-D1 thru 3) and the case firm employee knowledge (K6-E1 thru 3).

In general it is expected that it will be necessary to encourage the case employee tell four stories about their firm, one for each of the four perspectives in the SSBMO (stakeholders, products, processes and measurement). These stories should provide the information required to describe the case firm's business model.

Perspective	Item to Elicit Appropriate Story	Follow-up Questions
1. Stakeholder	Tell me a story about all the people, organizations and groups who have some relationship with your firm – who they are, what relationship do they have with you, why do they care about this relationship with you, what are their needs, what groups are they a part of, etc.	Tell me about your stakeholders – customers, employees, management, suppliers, distributers, investors, banker, auditor, community, non-human actors, etc. What are the positive or negative implications for any of these people being involved with your firm?
2. Product, Learning & Development	Tell me a story about the value propositions your firm offers to all the people you just mentioned?	Which value propositions are designed for which group of people? Are there any value propositions which create unintended (positive or negative) consequences for any of these groups?
3. Process	Tell me a story about how you deliver the value propositions to all the people you just mentioned?	Tell me about your processes – what capabilities do you need, and do you have all these in house, what resources (knowledge, raw materials, information) do you need, and do you have all these in house?
4. Measurement	Tell me a story about who of all the people you mentioned define success, how success is defined and how it is measured	Does anyone who is not an employee have any ability to define success? Are there any non-financial measures of success? E.g. Quality, Levels of toxic emissions, etc. What is the priority of achieving these vs. financial measures?

Table 6-50: Items to Gather Case Information (K6-E1 thru 3)

6.7.2.5 Items / Topics / Metrics to Assess Fit of Case Employee Knowledge (K6-E1 thru 3) to SSBMO Specific Instantiation (K6-BM1 thru 3)

Background

All the time in the interview will be used to gather feedback on these questions / topics.

These items will be given to the interviewee at the end of the formal briefing.

Metrics

These questions will gather feedback to be used subsequently to interpret values of the metrics shown in Table 6-51.

Aspect of Utility	Elicit Positive / Confirmatory Feedback	Elicit Negative Feedback / Opportunity to Improve Design
Generic	**M9**: Useful, has utility, to intended user	Not useful or produces adverse or unwanted effects
Quality	**M11**: Easy to Use	Hard to Use
Completeness	**M4**: Completeness: the efficiency of business model designers in using the SSBMO to describe business models	Incompleteness
Quality	**M6**: Comprehensibility: the efficiency of business model designers in using the SSBMO to describe business models	Incomprehensibility
Beauty	**M10**: Elegance	Inelegant

Table 6-51: Metric Values Resulting from Comparing Case Employee Knowledge Source (K6-E1 thru 3) and Case Business Model Described Using SSBMO (K6-BM1 thru 3)

Questions to Gather Feedback on Specific Instantiation of SSBMO

The questions shown in Table 6-52 assume the interviewee will answer based on their own process of comparing their knowledge of their firm's business model (K6-E1 thru 3) to the specific instantiation of the SSBMO (K6-BM1 thru 3), their firms business model described using the SSBMO and SSBMC.

The following preamble will be given prior to asking these questions:

The purpose of gathering this feedback is to

1. Improve the SSBMO, to make it more useful.

2. Determine where you believe the SSBMO is already useful to you and your firm.

When answering the following questions please consider how well (if at all) your knowledge of your firm – customers / markets, value propositions, business processes (operations / supply chain), and the way you measure your results – fits with, is recognized within, or has a likeness to the description of your business model presented at the earlier briefing meeting

Please be as direct and straight forward as possible in your responses.

Item # E3-Q-FI	**Item**	**Metrics**
1.	Do you "recognize" your business in this description of your business model? Why? Why Not?	M6: Comprehensibility / Incomprehensibility related to efficiency (may also get feedback on accuracy of the example instantiation)

Item # E3-Q-FI	**Item**	**Metrics**
2.	Are there any aspects of this description of your business model that are unclear to you? Which aspects? Why?	M6: Comprehensibility / Incomprehensibility related to efficiency (may also get feedback on accuracy of the example instantiation)
3.	In your opinion, if you were describing your firms business model to a existing or new colleague would using this description of your firm's business model be helpful? Why? Why not?	M6: Comprehensibility / incomprehensibility related to efficiency M9: Useful, has utility, to intended user / Not useful or produces adverse or unwanted effects (may also get feedback on the layout / format of the example)
4.	To what extent is it meaningful / useful to think of your business, its goals, operations, employees, customers, problems and opportunities, etc. in terms of this description of your business model?	M6: Comprehensibility / incomprehensibility related to efficiency M9: Useful, has utility, to intended user / Not useful or produces adverse or unwanted effects (may also get feedback on the layout / format of the example)

Item # E3-Q-FI	**Item**	**Metrics**
5.	In your experience of your firm's business model and making changes to your business (introducing new products, improving your operations, etc.) are the topics included in the description of business model appropriate? Why? Why not? If not, what needs to be added or removed?	M4: Completeness / Incompleteness related to efficiency (may also get feedback based on world-view, employee believes something in the business model description is inappropriate)
6.	a. Do you believe this description of your firm's business model could be useful to you and your colleagues? ● If so, how would it be useful and in what situations? b. If not, why not? c. Would you use it?	M9: Useful, has utility, to intended user / Not useful or produces adverse or unwanted effects
7.	Do you think this description of your firm's business model would be hard or easy to use to help design changes to your business (introducing new products, improving your operations, sustainability etc.), or identify and resolve problems in your business? Why? Why not?	M11: Easy to use / hard to use (may also get feedback based on world-view, employee believes something in the business model description is inappropriate)
8.	In your opinion is this an elegant or inelegant description of your business model Why? Why not?	M10: Elegant / Inelegant

Table 6-52: Items to Assess Fit of Case Firm Employee Knowledge (K6-E1 thru 3) to Specific Example of SSBMO Instantiation (K6-BM1 thru 3)

Closing Items to Gather Addition Feedback

The interview will be closed with the items shown in Table 6-53.

Item # E3-Q-C	**Items**	**Metrics**
1.	Do you have any final comments on the SSBMO?	Mx: Any, All, Metrics not considered
2.	Would you like to learn more about the SSBMO?	M9: Overall measure of Utility (may also measure fit of idea of business model with interviewees role)
3.	Do you have any comments about this interview or this research project?	Any, All, Feedback on the research process
4.	Thank-you for your time and feedback. I will send you a copy of the transcript to review to confirm its accuracy. I will send you a copy of a summary of the feedback you a have provided to confirm the accuracy of my analysis Would you like to receive a copy of my final thesis once it is completed?	

Table 6-53: Items to Close Case Firm Employee Feedback Interviews

6.8 Evaluation Activity Group 4 – Feedback Synthesis and Analysis (E4)

This section describes in detail the research design created to undertake the group of evaluation activities that synthesize and analyze the feedback on the utility of the SSBMO gathered by activity groups E1-E3.

This section describes the process by which

- The values of the metrics are determined from the comparator knowledge sources gathered by evaluation activity groups E1-E3
- Any gaps are identified by the comparison of the values of the metrics and the research question (RQ), research objectives (RO, R0-2), working hypotheses (WH1-4), evaluation hypotheses (EH) and the determined values of the metrics (Table 6-22).

Two types of gaps are searched for:

1. In artefact utility based directly on the determined values of the metrics of utility, i.e. has research objective RO1 & 2 been met? These are labelled GU1..n.
2. In research method rigor, if such gaps become apparent based on the process of determining values for the metrics of utility, i.e. has research objective RO0 been met? These are labelled GR1..n.

The results of activity group E4 are described in Chapter 8.

The identified gaps (GU1-n and GR1-n) are then input into activity group D4 which develops the summary candidate improvements to the SSBMO and SSBMC which might lead to improved utility (CU1-n and CR1-n respectively). These are described in Chapter 9.

The determining of the metric values from the comparator knowledge sources (K1-6) and the identification of the gaps is supported by and undertaken with the QSR Nvivo 9 qualitative analysis software tool[34].

This work was completed between September 1, 2012 and March 31, 2013.

[34] (QSR International, 2010)

6.8.1 Logical Entity Relationship Model for Evaluation Research Design

Figure 6-9 shows the evaluation research design expressed as an entity relationship model using the same diagramming formalism used to express the SSBMO (see 5.4.4, Figure 5-2)[35].

This diagram shows how the items / questions asked during evaluation activity groups E1-3, and the responses / answers received relate to the comparator knowledge, and subsequently the metric values and identified gaps (GU1-n and GR1-n,) and candidate changes (CU1-n and CR1-n). The comments boxes show the possible values of many of the entities.

[35] Note to simplify the ERD diagram not all many to many relationships have been "resolved" into entities and not all cardinalities are shown.

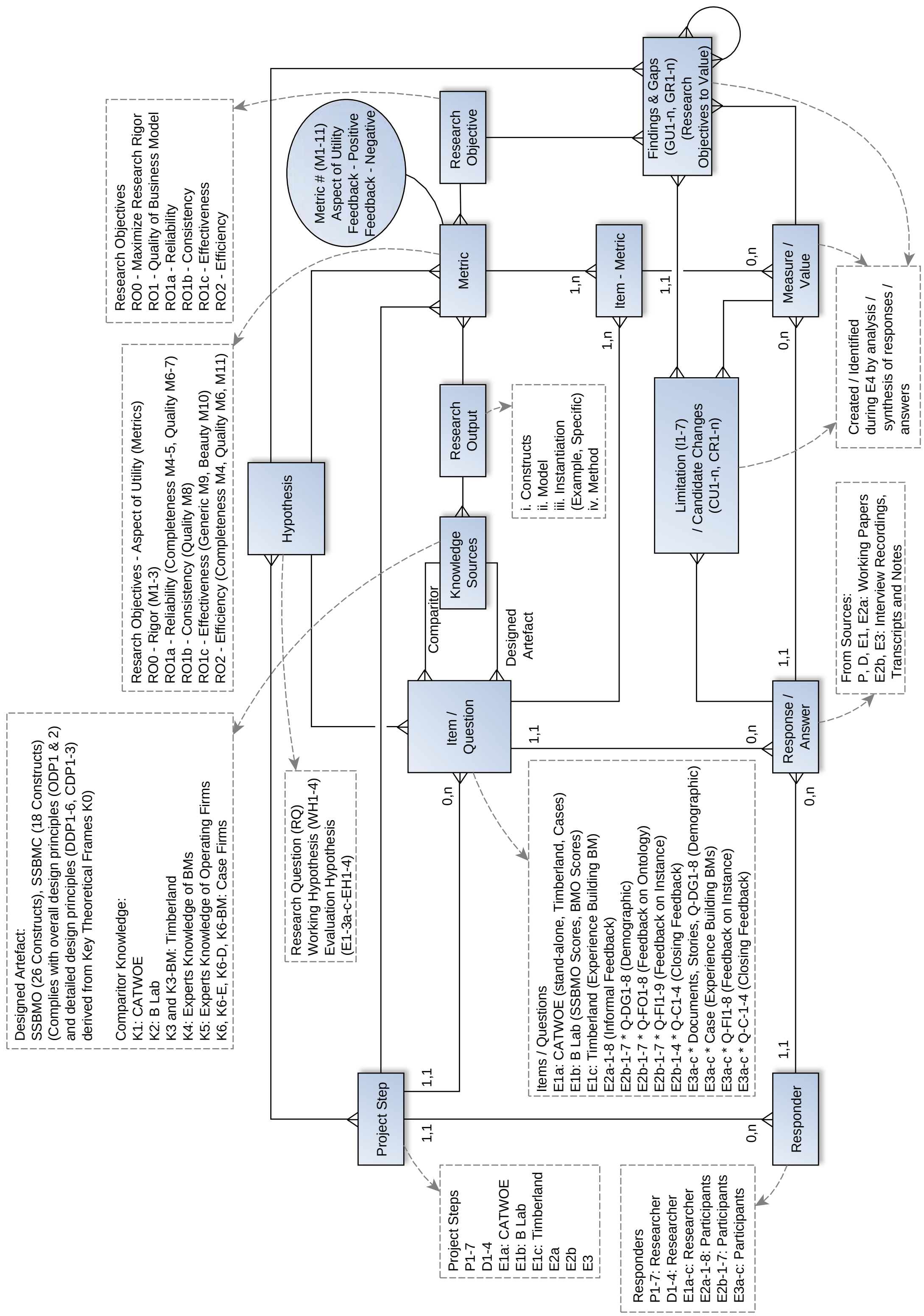


Figure 6-9: Evaluation Research Design Logical Entity Relationship Diagram

6.8.2 *Physical Database Design of Nvivo Qualitative Analysis Tool*

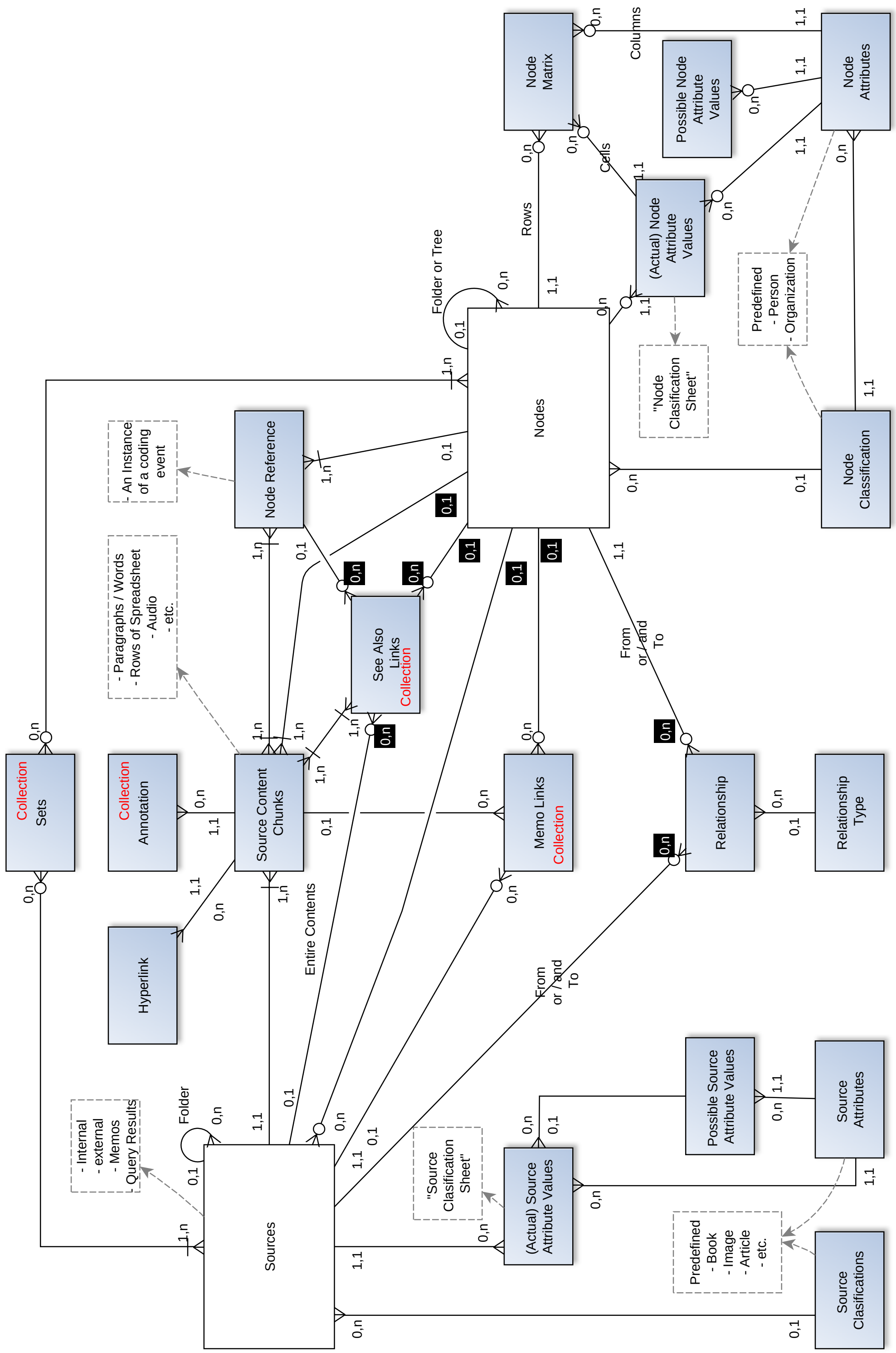


Figure 6-10: Nvivo Qualitative Analysis Tool Physical Database Design
(Reverse Engineered from User Interface by Researcher)

Figure 6-10 shows the internal (actual / physical) database structure of the Nvivo 9 qualitative analysis tool expressed as an entity relationship model using the same diagramming formalism used to express the SSBMO (see 5.4.4, Figure 5-2)[36]. This diagram was prepared through use of the tool and inferring the underlying database structure.

6.8.3 Physical Entity Relationship Model for Evaluation Research Design

In order to determine how the tool could be used to best support evaluation activity group E4, the logical ERM for the evaluation research design (Figure 6-9) was mapped onto the physical database design for the Nvivo tool (Figure 6-10). This lead to Figure 6-11 showing how the evaluation research design entities and relationships map onto the Nvivo physical database tables and relationships.

Each Nvivo entity (Figure 6-10) is mapped to one or more research design entities (Figure 6-9), described in the comment (dotted) boxes.

[36] Note to simplify the ERD diagram not all many to many relationships have been "resolved" into entities and not all cardinalities are shown. Relationships with cardinalities shown as white letters in a black box are mutually exclusive possibilities (i.e. in ERM terminology, roles).

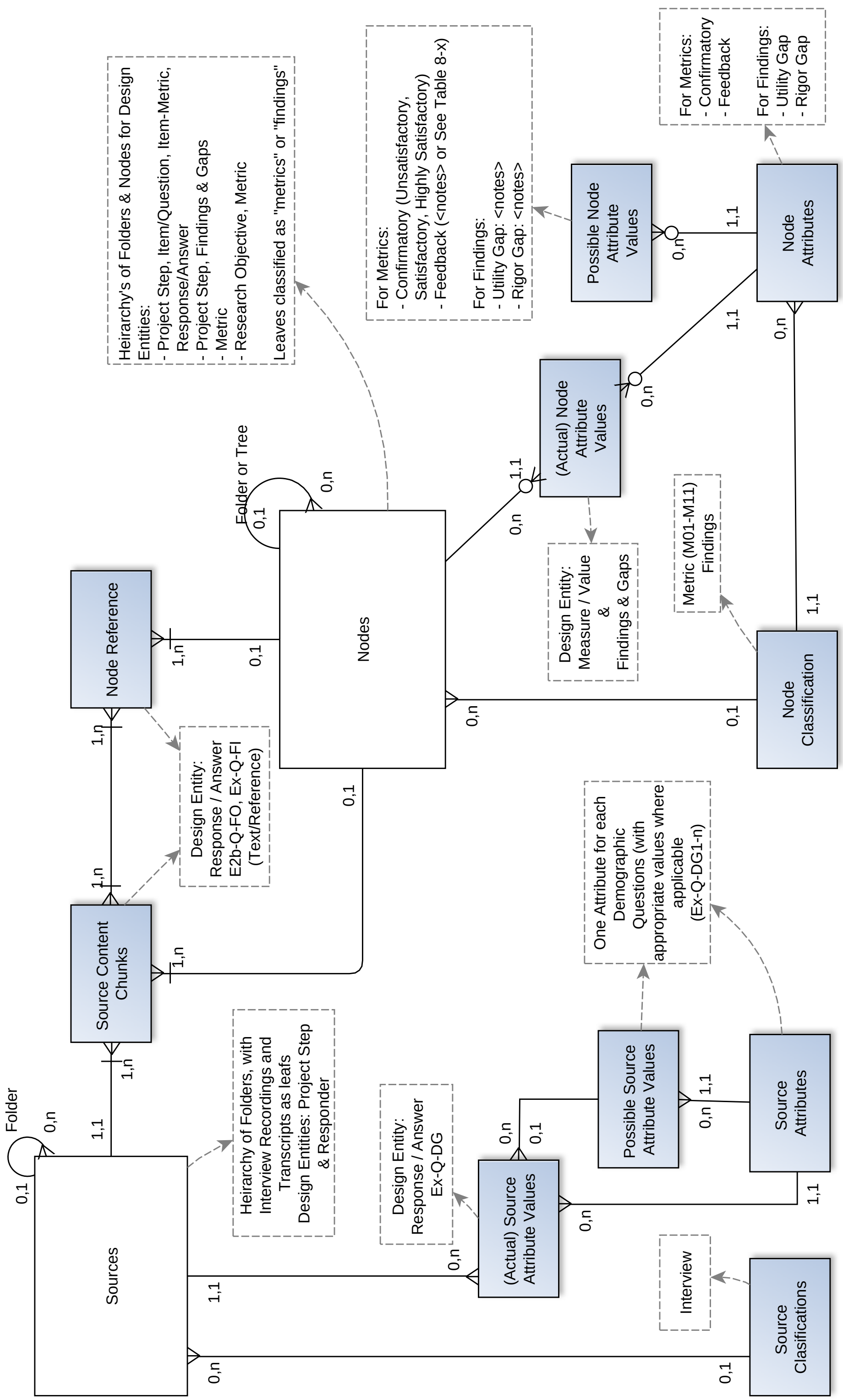


Figure 6-11: Physical Evaluation Research Design Mapped to Nvivo Tool Physical Database Design

Once the mapping is complete the Nvivo tool is loaded by all the "master data" concerning the evaluation research design. These master data are shown in the comments (dotted) boxes in Figure 6-9 and described throughout this thesis.

6.8.4 Determining Metric Values from Gathered / Created Comparator Knowledge

Once the comparator knowledge K1-6 was gathered by and created during evaluation activity groups E1-3 they were loaded / transferred into the Nvivo tool. For example: for E2b and E3 interviews were transcribed into the tool; for E1b the results of the comparison of the B Labs Impact Assessment survey, the SSBMO and BMO were loaded into the tool.

Each Response / Answer was recorded in Nvivo including its relationship(s) with the relevant instance(s) of the entities shown as related to the Response / Answer entity in Figure 6-9, i.e. Item / Question and Responder.

From this, using the definitions of the metrics M1-11 (Table 6-23), values were determined and recorded in the Measure / Value entity, related to the supporting Response / Answer. Comments from the interviewer's notes were also recorded as instances of the Comments entity, and related to the Response / Answer and / or Measure Value instances. A summary of the metric values is presented in Chapter 8.

6.8.5 Identifying Gaps between Values and Research Objectives

This is accomplished by considering the results of evaluation (the values of the metrics, recorded in the Measure / Value entity, supported by Comments) and comparing these against the research question and objectives (RQ, RO0-2), the working hypothesis (WH1-4) and the relevant evaluation hypothesis (EH). A process of analysis and synthesis is used to identify the gaps between the desired level of utility and research rigour and the achieved level of utility and research rigour. (GU1..n and GR1-n). The identified gaps are presented in Chapter 8.

6.8.6 Determining Metrics Values and Determining Gaps - Details

The next sections record the specifics of how comparator knowledge gathered / created by evaluation activity groups E1-3 is used to determine the values for relevant metrics (M1-11 , defined in Table 6-23) and then subsequently identify gaps (GU1-n and GR1-n).

6.8.6.1 Feedback Analysis & Synthesis of Values Captured in SSBMO Expectation / Desirability Matrix

As noted in 6.4.4, the use of the SSBMO Expectation / Desirability Matrix (Table 6-20) creates values for metrics M1, M2 and M3.

Gaps are then identified using analysis and synthesis by comparing the values of the above metrics with RQ, RO, RO0-2 and WH1-4.

6.8.6.2 Feedback Analysis & Synthesis of Values Captured in by CATWOE (E1a, E1c, E3)

The CATWOE comparative analysis technique is used in three evaluation activity groups as follows:

E1a: Values for metrics M4, M5 and M8 (Table 6-27) are determined from comparator knowledge K1 created via responses to questions in Table 6-28.

E1c: Values for metrics M4 and M9 (Table 6-33) are determined from comparator knowledge K3 and K3-BM via process of gathering publically availability information about Timberland and described Timberland's business model using the SSBMO (tabular form) and SSBMC (sticky notes) respectively.

E3: Values for metrics M4 and M9 (Table 6-47) are determined from comparator knowledge K6-E, K6-D and K6-BM via process of gathering information about each cases firm's business model from case firm employees and documents and describing the case firm's business model using the SSBMO (tabular form) and SSBMC (sticky notes) respectively.

Gaps are then identified using analysis and synthesis by comparing the values of the above metrics with RQ, RO, RO0-2, WH1-4 and E1a-H1-2.

6.8.6.3 Feedback Analysis & Synthesis of Values Captured in E1b (B Lab)

Values for metrics M4, M5 and M8 (Table 6-29) are determined by creating comparator knowledge K2 via a process of using the scoring system described in Table 6-30 and then applying the interpretation scheme described in Table 6-31.

Gaps are then identified using analysis and synthesis by comparing the values of the above metrics with RQ, RO, RO0-2, WH1-4 and E1b-H1-4.

6.8.6.4 Feedback Analysis & Synthesis of Values Captured in E1c (Timberland)

Values for metrics M4, M5 and M8 (Table 6-32, Table 6-34) are determined from comparator knowledge K3 and K3-BM via process of gathering publically availability information about Timberland and described Timberland's business model using the SSBMO (tabular form) and SSBMC (sticky notes) respectively.

Gaps are then identified using analysis and synthesis by comparing the values of the above metrics with RQ, RO, RO0-2, WH1-4 and E1c-H1-4.

6.8.6.5 Feedback Analysis & Synthesis of Values Captured in E2a

Values for metrics M4, M5, M6 and M7 (Table 6-35) are determined from comparator knowledge K4 and K5 via an informal process of engaging with a range of people in a range of situations during evaluation activity group E2a. These interactions included sharing information about the SSBMO and SSBMC, the basis and process of their construction, as well as an instantiation of the SSBMO (K3-BM, Timberland, using the tabular form of the SSBMO and the sticky notes on the SSBMC).

Gaps are then identified using analysis and synthesis by comparing the values of the above metrics with RQ, RO, RO0-2 and WH1-4.

6.8.6.6 Feedback Analysis & Synthesis of Values Captured in E2b

Values for metrics M4-7 and M9-11 (Table 6-38) are determined from comparator knowledge K4 and K4 (Table 6-37) via a process of:

1. Analyzing the responses to items E2b-Q-DG1-8 (Table 6-39) recorded in the transcripts of the feedback interview.
2. Applying the specifics of the metrics in Table 6-40 and analysing responses to items E2b-Q-FO1-8 (Table 6-41) recorded in the transcripts of the feedback interviews as a result of sharing information about the SSBMO and SSBMC and the basis and process of their construction.
3. Applying the specifics of the metrics in Table 6-42 and analysing the responses to items E2b-Q-FI1-9 (Table 6-43) of the feedback interviews as a result of sharing an instantiation of the SSBMO (K3-BM, Timberland, using the tabular form of the SSBMO and the sticky notes form of the SSBMC).
4. Analysing the responses to items E2b-Q-C1-4 (Table 6-44) recorded in the above transcripts.

Gaps are then identified using analysis and synthesis by comparing the values of the above metrics with RQ, RO, RO0-2, WH1-4 and E2b-H1.

6.8.6.7 Feedback Analysis & Synthesis of Values Captured in E2b

Values for metrics M4, M6, M9-11 (Table 6-46) are demined from comparator knowledge K6-E, K6-D and K6-BM (6.7.1.4-6.7.1.7) via a process of:

1. Gathering information about the case firm from the requested documentation (Table 6-48, K6-D) and using the information from those documents to describe the case firm's business model using the SSBMO (tabular form) and SSBMC (sticky notes) (K6-BM).
2. Analysing the responses to items E3-Q-DG1-7 (Table 6-50) recorded in the transcripts of the data collection interviews (K6-E) and using the information from

the transcripts to improve the description of the case firm's business model using the SSBMO (tabular form form) and SSBMC (sticky note form) (K6-BM).

3. Analyzing the responses to items E3-Q-DG1-7 (Table 6-49) recorded in the transcripts of the data collection interview.
4. Applying the specifics of the metrics in Table 6-51 and analyzing responses to items E3-Q-FI1-8 (Table 6-52) recorded in the transcripts of the feedback interviews as a results of sharing the case firms business model described using the SSBMO (tabular form) and SSBMC (sticky note form).
5. Analysing the responses to items E3-Q-C1-4 (Table 6-53) recorded in the above transcripts.

Gaps are then identified using analysis and synthesis by comparing the values of the above metrics with RQ, RO, RO0-2, WH1-4 and E3-H1.

6.9 Summary of Evaluation Detailed Research Design

The comprehensive approach to evaluation described above, derived from a thorough and systematic review of the relevant literature, coupled with the novel integration of ontology engineering, design science and systems thinking will provide a range of high quality positive and negative feedback.

This will result in the final iteration of the SSBMO produced by this research (output from build activity D3) being complemented with a list of potential improvements that, once made, may lead the SSBMO to being well suited to help solve the problem identified in the research objective with a high degree of utility: Increasing the quality (reliability, consistency, effectiveness) of strongly sustainable business models and the efficiency of business model designers who create them (Chapter 2, 3.6.6).

A summary of the evaluation activity stream detailed design is provided in Table II-3, at the end of Part II (immediately below).

Part II: Closing

Review and Summary

II-5 Review

Having completed the journey through the relevant literature and the detailed design of this research the destination of this research is now clearly visible and the approach to rigorously tackling its challenges designed. The next part, Part III records the results of undertaking the research design that was documented in this part. Part III documents the results of building and evaluating a strongly sustainable business model ontology and canvas.

With the detailed research design completed (Chapters 4 thru 6) the overall research design presented in the Figure 3-21 can be revised in light of the additional detail described – i.e. adding the activity groups within the prepare, build and evaluate activity streams. This is shown in Figure II-3.

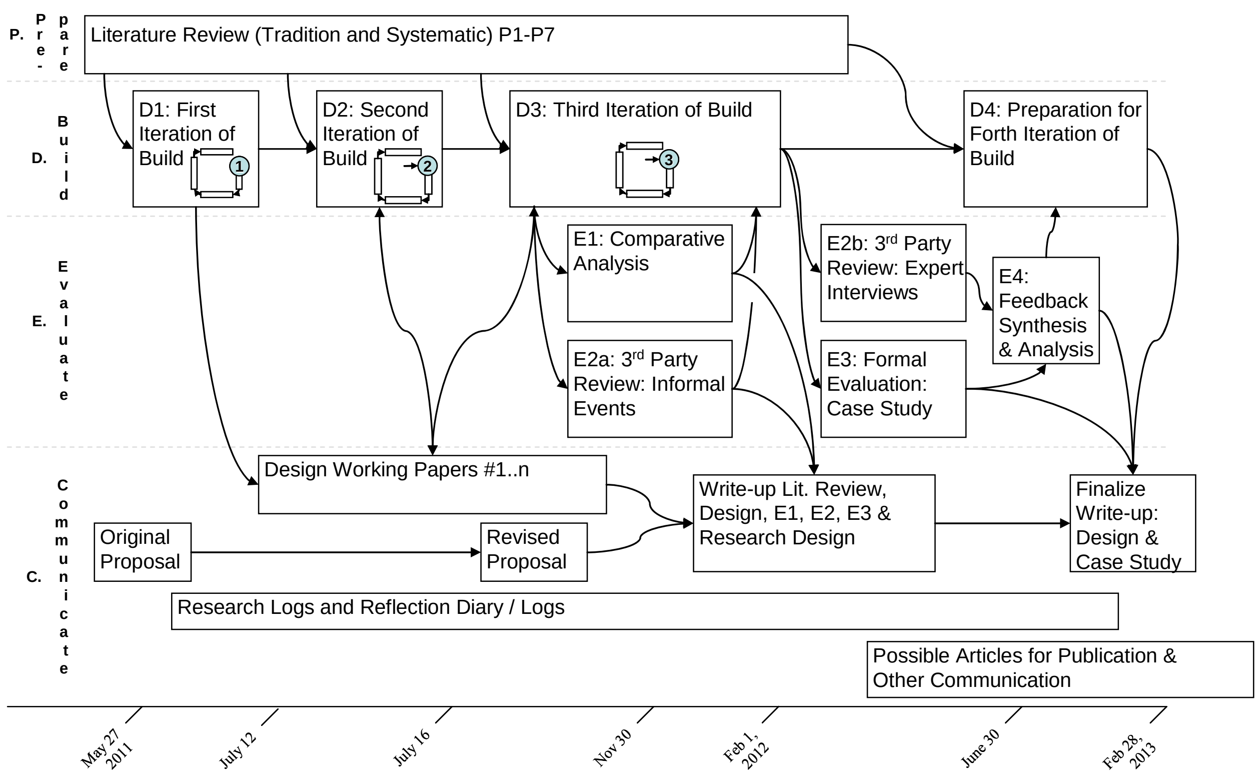


Figure II-3: Detailed Research Process

The process inquiry consists of four related “swim lanes” one for each of the four activity streams: Prepare (P – P1-P7), Build (D – D1-D4), Evaluation (E – E1-E4) and Communicate (C).

Within this swim lane structure the practical sequence of this research project is as follows:

1. The original project proposal is written and approved (MES II-III exam May 27, 2011) (C).
2. The templates to capture the research logs, reflections, and research diary are established and start to be used (C).
3. To understand the problem and the applicable knowledge, the “key theoretical frames” (K0) start to be identified, which will be required to build and evaluate the SSBMO (P4)
4. Iteratively with P4 the overall research process is designed (P1-3) and elaborated (P5-7).
5. Using the initial output from the literature reviews conducted in the preparation activity stream (P1-4) a first version of the SSBMO artefact (constructs and model) is built (D1) and described in the Design Working Papers (C). The build activity uses an iterative systems thinking approach examining the function, structure, process and context of business models.
6. Details of the SSBMO artefact are captured in the initial version of the “Design Working Papers” (C).
7. Based on learning from the first version of the SSBMO further literature review work is undertaken (P4) and a second version of the SSBMO artefact is built (D2) and described in the Design Working Papers (C). Again an iterative systems thinking approach is applied to this build activity.
8. Based on learning from the second version of the SSBMO further literature review work is undertaken (P4) and an initial third version of the SSBMO artefact and an

first version of the SSBMC are built (D3 is started) and described in the Design Working Papers (C). Again an iterative systems thinking approach is applied to this build activity.

9. Based on the accumulated learnings a revised project proposal is prepared, reviewed and approved (August 8, 2011) (C).
10. The detailed research design of the evaluation activities is determined and documented (P, E & C).
11. The Comparative Analysis and Informal Third Party Review Evaluation activities are undertaken (E1, E2a) and written up (C).
12. Based on the learning from evaluation activities E1 and E2a as well as the learning from the initial work on the third version of the SSBMO and the first version of the SSBMC the SSBMO artefact is finalized (D3 is completed) and described in the Design Working Papers (C).
13. Using the completed third version of the SSBMO the Formal Third Party Review and Case Study evaluation activities are undertaken (E2b and E3) and written up (C).
14. Based on the learning from evaluation feedback synthesis & analysis activities E4 the feedback that could be used to revise the SSBMO is prepared (D4).
15. The final write up of all aspects of the project is then undertaken (this thesis document), and submitted for review and approval (C).
16. Activities to communicate the results of the thesis work to practitioners and academics are then undertaken (C)

II-6 Preparation Detailed Research Design Summary (P1-7)

Using Table 3-13 as a structure, Table II-1 summarizes Chapters 1 thru 4: the Goals, Outcomes and Methods relative to each of the Design Science Research Outputs for the Preparation Research Activity Stream.

		P. Preparation Research Activity Stream		
	Output Elements	Goals	Outcomes	Methods
Research Output	i. Constructs	Identify the relevant issues for profit first and strongly sustainable business models	Identify overall and detailed design principles (ODP1 & 2, DDP1-6) and build design principles (BP1 & 2)	Traditional Literature Review (P1-5,P7) Systematic Literature Review (P4, P6)
	ii. Models	Identify the "logic" of a profit first and strongly sustainable firm's business model		
	iii. Instantiations	Determine how, with limited explanation, a manager in a firm may be able to understand the ontology	Identify strongly sustainable business model canvas design principles (CDP1-3)	
	iv. Method	Identify the overall and detailed research designs of the highest quality possible maximizing rigour, minimizing bias, and hence legitimacy of the research output	Research design that meets first research objective (RO0)	

Table II-1: Summary of the SSBMO Preparation Research Activities and Outputs (P1-7)

II-7 Build Detailed Research Design Summary (D1-4)

Using Table 3-13 as a structure, Table II-2 summarizes Chapters 1 thru 3 and 5: the Goals, Outcomes and Methods relative to each of the Design Science Research Outputs for the Build Research Activity Stream.

<table>
<tr><th colspan="2"></th><th colspan="3">D. Build Research Activity Stream</th></tr>
<tr><th></th><th>Output Elements</th><th>Goals</th><th>Outcomes</th><th>Methods</th></tr>
<tr><td rowspan="3">Research Output</td><td>i. Constructs</td><td>Identify the relevant issues for strongly sustainable business models</td><td>SSBMO will contain descriptions of the entities, and the contextual systems / groupings important to describing strongly sustainable business models</td><td rowspan="3">D1-D4:Apply build design principles (BP1, & 2) within overall design principles ODP1 & 2), using Osterwalder’s BMO as a anchor along with other key theoretical frames (K0, K0-PF, K0-SS), as summarized in detailed design principles (DDP1-6)</td></tr>
<tr><td>ii. Models</td><td>Describe the “logic” of a strongly sustainable firm’s business model</td><td>SSBMO will contain descriptions of the relationships between the entities, systems and groups and hence the “logic” of the business model</td></tr>
<tr><td>iii. Instantiations</td><td>With limited explanation, have a manager in a firm be able to understand the ontology</td><td>SSBMO (the constructs and the model of their relationships) will be expressed in a visually attractive diagrammatic form for presentation to mangers (the SSMBC)</td></tr>
</table>

Table II-2: Summary of the SSBMO Build Research Activities and Outputs (D1-4)

II-8 Evaluate Detailed Research Design Summary (E1-4)

Using Table 3-13 as a structure, Table II-3 summarizes Chapters 1 thru 3 and 6: the Metrics, Evaluation Activity Groups, Techniques and Comparator Knowledge Sources relative to each of the Design Science Research Outputs for the Evaluate Research Activity Stream.

		E. Evaluate Research Activity			
	Output Elements / Units of Analysis	**Metrics**	**Evaluation Activity**	**Technique**	**Knowledge Comparators: Sources & Designed Artefacts**
Research Output	i. Constructs	Completeness Level of Detail	E1: Comparative analysis	Static Analysis	K1. CATWOE against Timberland's Business Model (K3-BM) described using instantiation of SSBMO and SSBMC K2. B Lab Impact Assessment Survey against constructs in SSBMO (K0-SS) and BMO (K0-PF) K3. Publically available information about Timberland's Business model against SSBMO and SSBMC
		Completeness Level of Detail Comprehensibility Elegant	E2: 3rd Party Review	Interview, Indirect case study	K4. 3rd Party experts with a range of world-views against constructs in prescriptive SSBMO (K0-SS) and BMO (K0-PF) K5. 3rd Party experts with a range of world-views against instantiations of individual constructs required to describe Timberland's Business Model (K3-BM)
	ii. Model	Completeness Level of detail Internal consistency	E1: Comparative analysis	Static Analysis	K1 CATWOE against prescriptive SSBMO (K0-SS) and BMO (K0-PF) K2. B Lab Impact Assessment Survey against SSBMO (K0-SS) and BMO (K0-PF) K3. Publically available information about Timberland's Business model against SSBMO and SSBMC
		Completeness Level of detail Comprehensibility Real-world likeness to artefact Internally consistent Elegant	E2 : 3rd Party Review:	Interviews	K4. 3rd Party experts with a range of world-views against prescriptive SSBMO (K0-SS) and BMO (K0-PF) K5. 3rd Party experts with a range of world-views against instantiations of relationships between constructs required to describe Timberland's Business Model (K3-BM)
	iii. Instantiations (aka Business Models)	Useful Completeness	E1: Comparative Analysis	Static Analysis	K1. CATWOE against Timberland's Business Model (K3-BM) described using instantiation of SSBMO and SSBMC
		Useful Elegant Completeness Comprehensible Easy to use	E2: 3rd Party Review	Interviews	K4. 3rd Party experts with a range of world-views against prescriptive SSBMO (K0-SS) and BMO (K0-PF) K5. 3rd Party experts with a range of world-views against Timberland's Business Model (K3-BM) described using instantiation of SSBMO
		Useful Elegant Completeness Easy to use	E3: Case study: data gathering + interviews	Data gathering + interviews	K1. CATWOE against specific firm's business model (K6-E and K6-D) described using SSBMO and SSBMC (K6-BM-#). K6-E#. Senior managers at firms with a range of world-views against their firms business model described using SSBMO and SSBMC (K6-BM#)

Table II-3: Summary of the SSBMO Evaluate Research Activities and Outputs (E1-4)

Part III: The Designed Artifacts
The Strongly Sustainable Business Model Ontology and Canvas

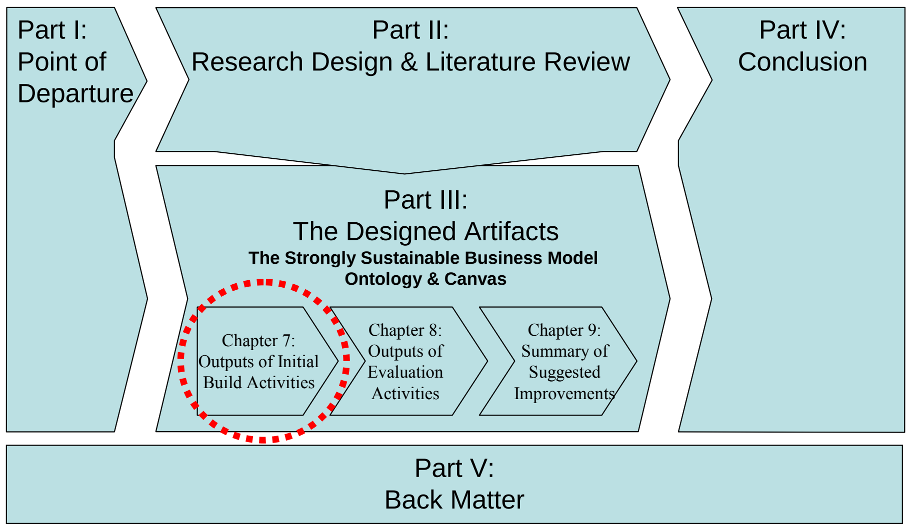
> *You may never know what results come of your action, but if you do nothing there will be no result* — Mahatma Gandhi

Having completed the design of this research and the review of the relevant literature, this part describes the results of executing the research design, including:

- The outputs of undertaking the construction of the Strongly Sustainable Business Model Ontology artefact and the visual design tool it powers, the Strongly Sustainable Business Model Canvas (Chapter 7).
- The outputs from the evaluation the utility of the SSBMO (Chapter 8).
- The analysis of evaluation leading to candidates for improvement that could enhance the utility of the SSBMO (Chapter 9).

Chapter Seven: Outputs of Build Activities – The Designed Artefacts

Reality is that which, when you stop believing in it, does not go away —
Philip K. Dick



This chapter describes the output executing the build activity stream (Chapter 5), specifically the first three activity groups (D1-D3). These apply the ontology Overall, Detailed and Canvas Design Principles (ODP1-2, DDP1-6, CDP1-3) developed in the review of the key theoretical frames (Chapters 3 and 4) to create the SSBMO and SSBMC artefacts. This chapter once again applies the three steps set-out at the start of Part II as embedded in the first build activity stream build principle (BP1, Chapter 5). The search (A) of the literature for the relevant details of the key theoretical frames required to create a SSBMO and a SSBMC is presented. From this search a reflection (B) that applies (C) the detailed choices made and a description of the SSBMO and SSBMC is provided.

7.1 Introduction

This chapter describes the designed artefacts at the heart of this research: the Strongly Sustainable Business Model Ontology (SSBMO) and the visual design tool it conceptually powers, the Strongly Sustainable Business Model Canvas (SSBMC).

The overall research question (RQ) for this research was refined into two aspects (introduced in 3.5.3.4, summarized in 3.6.6):

RQa: How can strong sustainability emerge as an outcome of an organization understood as a multi-minded ideal-seeking purposeful system (analysis), and what systems contain / provide context for an organization so understood (synthesis)?

RQb: How can such an understanding be modelled using an ontology in order to enable a tool useful for managers attempting to design the conditions from which strongly sustainable outcomes may emerge from and for their organizations?

RQa was answered through the preparation activities, described in Chapter 4. In describing the SSBMO and SSBMC this chapter starts to answer RQb. The remainder of this question is answered by the results of evaluating the utility of the designed artefacts conducted by the evaluation activity stream (Chapter 8).

The research design described in Chapter 5 is executed by following Build Principle 1 (BP1, 5.4.1). This starts to answer RQb through the creation of the SSBMO and SSBMC artefacts. The first ontology Overall Design Principle (ODP1) states that the designed artefacts must be compatible with the latest formal, natural, and social scientific knowledge of strong sustainability. As per the build research design, in order to ensure this, during the design process the artefacts' adherence to the ontology Overall, Detailed and Canvas Design Principles derived from the key theoretical frames is repeatedly confirmed (Chapter 3, ODP1 & 2, Chapter 4, DDP1-6, CDP1-3).

Thus the research design produces the SSBMO and SSBMC artefacts which adhere to the overall conception of a strongly sustainable business model (DDP2, 4.4.6):

A description of the logic of an organization's existence: who it does it for, to and with; what it does now and in the future; how, where and with what does it do it; and how it defines and measures its success.

This chapter captures the designed artefacts by providing a detailed definition of them (as per 5.4.3). To adhere to DDP1, these descriptions of the SSBMO are also visually coded in a detailed diagrammatic formalism (5.4.4, SM4) and in a summary diagrammatic representation (5.4.5, SM3). Additionally, to adhere to CDP2, the SSBMC visual design tool, conceptually powered by the SSBMO is also described and a diagrammatic representation provided (5.4.6, SM5a-c). These diagrammatic views of the artefacts may be found in the accompanying electronic files listed under the "List of Supplementary Materials" in the Front Matter of this thesis (SM3-5).

7.1.1 The Designed Artefact

The SSBMO is described (captured) using the Entity Relationship Modelling (ERM) formalism (5.4.3) and represented (coded) using the Entity Relationship Diagramming (ERD) formalism (5.4.4). Table 5-1 shows the correspondence between the overall outputs of this Design Science research and the elements of an entity relationship model.

Specifically the SSBMO consists of a number of elements that are required to be included in an ontology of strongly sustainable business based on the literature (as summarized in the design principles):

1. A number of entities (nouns): the key concepts and / or constructs. These entities are of two types: generalization and specific.
2. A number of inter-relationships (verbs): these relate the key concepts and / or constructs).

Entities in the SSBMO can be thought of as the minimum set of necessary and sufficient topics (or questions), suggested by the literature, that a business model designer must respond to. A business model designer who uses this same body of literature to determine answers to all the questions posed by the SSBMO has the possibility of creating a business model that may enable strongly sustainable outcomes (5.4.3). Considering the topics as questions is used throughout this chapter as a technique to describe and explain the SSBMO.

Providing some advice to business model designers on how to best answer these questions posed by each of the entities, based on the literature is provided in 7.7.

The concepts identified in the literature and represented by instances of the entities within the SSBMO may be:

- Socially constructed. The concepts required to describe a business model exist initially in the mind(s) of the persons involved in or impacted by a business. Subsequently instances of these entities may take a tangible form via a range of artefacts (e.g. product descriptions; legal agreements such as acts of incorporation, purchasing, sales and partnership contracts; advertising materials; marketing collateral; business process / service designs, etc.).
- Tangible, having some 'objective' existence in the world (e.g. individual humans, specific instances of other life, and more generally any specific stock of biophysical material; flows of matter and / or energy arising from eco-system services and / or transformation processes undertaken by a firm, i.e. products and the associated raw materials and waste streams).

Further detail and examples are provided in 7.4.1.1.

Finally, the majority of the specific entities have a summary / detailed relationship with another specific entity. In these cases the concept being captured and coded is best modelled by a pair of entities, one each for the summary and detailed aspects of the concept. Further examples of summary and detailed relationship entities are provided in 7.4.1.2.

7.1.2 Chapter Structure

This chapter is structured as follows:

- The remainder of this section (7.1) provides guidance on how to read this chapter and the accompanying supplementary materials.

- Sections 7.2 thru 7.4 describe the SSBMO artefact.
  - Section 7.2 introduces the description of the SSBMO, including an overview of the changes made to the BMO (as per Build Principle 1 – BP1, 5.4.1).
  - Section 7.3 describes the generalization entities in the SSBMO. These provide the context and boundaries for the other entities within the SSBMO (as per DDP3).
  - Section 7.4 describes the specific entities in the SSBMO. These enable representation of the concepts required to adhere to the ontology detailed design principles (DDP1-6).
- Section 7.5 describes the SSBMC artefact. This adheres to the canvas design principles (CDP1-3).
- Section 7.6 provides detail of the differences between the SSBMC and the BMC (as per Build Principle 1 – BP1, 5.4.1).
- To assist Business Model Designers in answering the questions posed by the SSBMO, as introduced in 4.7.2.6, section 7.7 provides proto-Strongly Sustainable *Business* Design Principles (pBDPs) derived from the same literature used to derive the *ontology* Overall and Detailed Design Principles (ODP1 & 2, DDP1-6, Chapters 2 thru 4).
- Finally, for completeness, 7.8 lists a number of coding and capture inconsistencies found in the BMO and describes how these are resolved in the SSBMO.

7.1.3 How to Read this Chapter

In order to most easily comprehend this chapter it is recommended that the reader be familiar with:

1. The Strongly Sustainable Business Model Ontology Overall, Detailed and Canvas Design Principles (Chapter 3, ODP1 & 2, Chapter 4, DDP1-6 and CDP1-3). These earlier Chapters should be consulted for the citations to the literature that support the constructs and relationships in the SSBMO. This literature is summarized in DDP1-6, hence citation of the works that justify the design choices in the SSBMO and SSBMC are not repeated here. In a number of cases citations related to some details of the design, felt insufficiently supported by the Detailed Design Principles, are provided.

2. The Business Model Ontology as described in Osterwalder's PhD (Osterwalder, 2004b; Osterwalder, 2004a). Supplementary Material SM1 summarizes the BMO; SM2 provides the detailed diagrammatic formalism showing the detail of all the relationships and attributes. The diagrammatic formalisms used are the same as for the detailed and summary SSBMO diagrams. The literature reviewed in Chapter 4 (4.5) and Osterwalder's PhD dissertation should be consulted for the citations to the literature which support the constructs and relationships in the BMO (these are summarized in DDP5, hence citation of the original works used by Osterwalder to justify his design choices are not repeated here).

3. The Business Model Canvas as described in Osterwalder et. al's popular works and practitioner tools (Osterwalder & Pigneur, 2009; Osterwalder, 2010, 2011; Osterwalder, 2011; Osterwalder & Smith, 2012; A. Smith, Osterwalder, Business Model Foundry GmbH, & Hortis - Le Studio, 2011)[1].

4. The formalisms used to describe (capture), diagram (code), and summarize the design artefacts. See Chapter 5 (5.2.6, 5.4.4-5.4.8)

[1] The Business Model Canvas may be downloaded from http://businessmodelgeneration.com/downloads/business_model_canvas_poster.pdf

Finally it is suggested that this chapter may be more easily comprehended if it is read in conjunction with viewing:

- The supplementary materials that contain the visualizations of the SSBMO and SSBMC (SM3 – SM5) (having these materials to hand is **HIGHLY** recommended to aid comprehension). See the Front Matter of this thesis for details of the electronic files containing these supplementary materials.

- The appropriate section of Osterwalder's PhD (Osterwalder, 2004a, pp.42-103) and the relevant supplementary materials. Detailed references are provided in the text to facilitate the readers understanding of the significant differences between the SSBMO and BMO.

7.2 Strongly Sustainable Business Model Ontology

This section introduces the description of the SSBMO.

7.2.1 Summary of Results Build

The overall approach to building the SSBMO artefact stated in Build Principle 1 (BP1, 5.4.1) and operationalized by answering the following three questions:

Given constructs and model that constitute the BMO:

1. What's missing from…
2. What needs to be changed in…
3. What, if anything, needs to be deleted from…

… the BMO to create a SSBMO that adheres to the overall and detailed design principles (ODP1 & 2, DDP1-6)?

The overall answer to these questions is provided below. Detailed justification for the answer is provided in sections 7.3 and 7.4.

A summary of the changes between the BMC and the SSBMC is provided in 7.6.

7.2.1.1 Overall Rationale for Changes to the BMO

Applying BP1 and based on ODP1 & 2 and DDP1-6 derived from the supporting literature reviewed in Chapter 3 and 4, a gap analysis and overall resolution design was developed during activity groups P4 and D1-3. The thirteen gaps between the BMO and the design principles were identified. Five overall resolutions were designed to close these gaps: Boundaries & Goals, Stakeholders, Value Propositions, Processes and Modelling. The gaps identified and the proposed resolutions are described in Table 7-2.

While all the literature reviewed in Chapters 3 and 4 informed this analysis and resolution design, a few works were found to be key. For brevity, in Table 7-2 these are referred to by the primary Authors name as show in Table 7-1 enclosed in square brackets (to differentiate these from normal citations). Please consult the review of these and related works in the referenced sections of Chapter 3 and 4 as well as the specific works cited in Table 7-1.

Label Used (Ordered Alphabetically)	Role in Identifying Gap and Designing Resolution	Key Citation	Reference to Review of this and Related Works
[B Lab]	Resolution Design Inspiration	(B Lab, 2009)	4.3.2.3 4.6.5.2
[Blattberg]	Gap Identification and Resolution Design Inspiration	(Blattberg, 2000)	3.5.3.1 4.5.5.2 4.6.5.2
[Gharajedaghi]	Gap Identification and Resolution Design Inspiration	(Ackoff, 1972; Gharajedaghi, 2011)	3.4.3 3.5.2.2 3.5.3.2 3.5.4.3
[Hart]	Gap Identification and Resolution Design Inspiration	(Hart, 1995; Hart & Sharma, 2004)	3.5.3.2 4.5.5.8
[Jackson]	Gap Identification	(Jackson, 2000)	3.2.1.6 3.5.2.2 4.6.4
[Kaplan]	Existing / Source Ontology	(Kaplan, 1996)	4.5.5.5
[Lawn]	Gap Identification and Resolution Design Inspiration	(Lawn, 2001; Lawn, 2004)	3.5.1.3 4.6.4
[Max-Neef]	Gap Identification and Resolution Design Inspiration	(Jolibert, Max-Neef, Rauschmayer, & Paavola, 2011; Latour, 2005; Max-Neef, Elizalde, & Hopenhayn, 1991)	3.5.3.1 4.4.3.4
[McDonough]	Gap Identification and Resolution Design Inspiration	(McDonough & Braungart, 1998; McDonough & Braungart, 2002)	3.5.3.1 4.6.3.4
[Osterwalder]	Existing / Source Ontology (as per BP1)	(Osterwalder, 2004b; Osterwalder, 2004a)	3.5.1.3-3.5.1.4 3.5.3.2 3.5.4.5 4.4.5.3-4.6.5.9 5.2.6 5.4.1
[Ulrich]	Gap Identification and Resolution Design Inspiration	(Ulrich, 1993; Ulrich, 2002)	3.2.3.2 3.5.3.1-3.5.3.2

Table 7-1: Key Works Cited in Table 7-2

Design Principle Used to Identify Gap	Gap #1-3 Identified Between BMO and SSBMO Design Principles (Boundaries & Goals)
ODP1 DDP2 DDP4	1. Osterwalder (and most other business model scholars) conceive of the primary (sometimes only) purpose of the firm to be monetary profitability and hence the purpose of the business model is to describe the “money earning logic of a firm” [Osterwalder, p.15]
ODP2 DDP5 DDP6	2. Osterwalder (and most other neo-classical macro-economic and business scholars) conceives that ultimately value can only be expressed in monetary terms as measured by profit in monetary units. It is already common, though far from universal, for the primary concern of a sub-set of a firm’s stakeholders to be broader than exclusively monetary profitability. Stakeholders interested in receiving integrated environmental, social and monetary value is required for strong sustainability outcomes to emerge [Blattberg, Lawn].
DDP3	3. Osterwalder does not explicitly consider the boundary conditions that define a firm and the holonic context in which a firm operates. Kaplan’s conception of the four Perspectives within a Balanced Scorecard as used by Osterwalder to organize the BMO has the same drawback, e.g. “financial”, “customers”, “internal processes”, “learning and growth” implicitly only consider items within the profit-first concept, with a limited focus on the context of the firm. Scholars of business pay limited attention to the question ‘what is the whole of which a firm is a part?’ [e.g. systems thinking Ackoff, Ulrich, Jackson]. Hence any risks arising from the intentional and unintentional ‘impact’ on society, the environment and the economy of the concepts represented in a profit-first business model are excluded from consideration by omission.

Proposed Resolution One
A strongly sustainable business model conceives of an organization as a social construct that arises from the informal or formal agreement of many minds (the stakeholders) on the purpose of that organization. Generally the agreement results from the belief that an organization can more effectively serve (some of) of those minds' divergent needs / purposes better than other alternatives. i.e. Organizations are purposeful multi-minded ideal seeking systems whose stakeholders define the ideal goal [Gharajedaghi]. This aligned with concept of a "Patriotic Corporation" [Blattberg]. Hence, a strongly sustainable business model must explicitly: ● Consider firm boundary conditions as defined by the agreement on the purposes of the multiple minds who are stakeholders in the firm which can be met through the value propositions and processes of that firm [Gharajedaghi, Ulrich]. ● Consider the system of systems of which an organization is a part (including other organizations), as well as the system of systems that comprise the organization [Jackson, Lawn]. ● Include the social relationships and 'objective' (physical) materials to which the organization needs 'privileged access'[2] in order to fulfill the organizations' agreed purposes. This includes relationship of these materials to all other human and non-human actors who may 'share' such access [Max-Neef, McDonough]. ● Redefine profit to include the environmental, social and monetary based on a range of measures in a range of units [Blattberg, McDonough]. This assumes that for owners and managers to maximize tri-profit at a point in time and over time it is legally possible for them to attempt to manage the process of doing so [B Labs].

[2] i.e. some combination of: legal ownership of, rights to access and / or use, social control over / access to, and / or physical control over / access to (See 7.4.5.4 for full definition of 'privileged access')

<table>
<tr><th>Design Principle Used to Identify Gap</th><th>Gap #4-6 Identified Between BMO and SSBMO Design Principles (Stakeholders)</th></tr>
<tr><td>DDP5</td><td>4. Osterwalder’s conception of a business model only includes customer and to a limited extent other actors. This excludes the possibility of considering the needs of the majority of types of potential stakeholders in a business model. The literature suggests that achieving strong sustainability requires firms to interact with a wide range of stakeholders [Hart].</td></tr>
<tr><td>DDP5
DDP6</td><td>5. Osterwalder’s concept of a business model excludes non-human actors, non-customer human actors, and the needs / purposes of all actors. Further the BMO provides no consideration of the mechanisms by which an organization can consider (on a equal footing): the needs / purposes of actors who have made themselves explicitly known as wishing to be its stakeholders, and those who have not made themselves known but who are impacted by the organization [Max-Neef].</td></tr>
<tr><td>DDP5
DDP6</td><td>6. Osterwalder ignores the key process of how the many potential human and non-human actors whose minds may inform the purpose of an organization are legitimated as stakeholders of a firm at the point in time being described by the business model (past, current or future state). Further once legitimate stakeholders are identified the processes of determining how much power they will have over which decisions is not considered [Hart].</td></tr>
<tr><th colspan="2">Proposed Resolution Two</th></tr>
<tr><td colspan="2">A strongly sustainable business model includes all stakeholders: stakeholders are actors whose needs / purposes have been legitimated by the organization as ones it intends to generate value for, or whom impact or are impacted by this value generation. Non-human actors may be legitimately represented by human stakeholders. i.e. stakeholders are actors who are relevant in some way to the firm; all actors are potential stakeholders over time [Hart].

In a strongly sustainable business model actors have needs / purposes related to all aspects of their survival and flourishing [Max-Neef]. A stakeholder is a role that an actor takes on based on a sub-set of their total needs / purposes that they believe could be fulfilled by becoming a stakeholder of firm [Gharajedaghi, Max-Neef, Hart]. (Customers are just one stakeholder role an actor may take, employee is another, etc. Actors may have multiple stakeholder roles simultaneously with the same or multiple organizations in a single business model).</td></tr>
</table>

<table>
<tr><th>Design Principle Used to Identify Gap</th><th>Gap #7-10 Identified Between BMO and SSBMO Design Principles (Value Propositions)</th></tr>
<tr><td>DDP6</td><td>7. Osterwalder (and most neo-classical business scholars) formally conceive value in the context of a business model as only possibly being created for customers (positive value generation) and not destroyed (negative value generation) nor a combination of the two [Max-Neef].

Further, Osterwalder only considers positive value in the context of customer stakeholders [Hart].</td></tr>
<tr><td>DDP6</td><td>8. Osterwalder's conception of a business model is to serve as tool to help design a new / changed / improved operational business in order to generate more monetary profit via the creation of (more) positive value for customer stakeholders. By implication the use of the tool for this purpose is intended to be an (important) part of the "change the business" process. However, as a result, any value to the customer (or other) stakeholders that could be generated by designing an improved "change the business" process is not in scope of the tool. [3]</td></tr>
<tr><td>DDP6</td><td>9. As Osterwalder only conceptualized customer stakeholders, his conception of value is necessarily focused only on customers. Hence, the potential for value to be conceived of as something that non-customer stakeholders might wish to receive or avoid is omitted [Max-Neef, Hart].</td></tr>
<tr><td>DDP4

DDP6</td><td>10. This same conceptualization also excludes the possibility that some stakeholders (e.g. owners, employees) would see positive value in a firm's ability to survive over time through adaption [Kaplan][4].</td></tr>
<tr><th colspan="2">Proposed Resolution Three</th></tr>
<tr><td colspan="2">A strongly sustainable business model has at (most) points in time at least one stakeholder who has a need to see that organization remain in existence for some period time into the future[5]. When this occurs, given the only constant is change, that stakeholder's need can only be met through a value proposition delivered by processes that adapt the organization's other value propositions and processes to enable the firm to flourish in future changed circumstances.

This requires a strongly sustainable business model to accommodate capabilities to recognise the need for and to subsequently change value propositions as the needs of actors and their stakeholder roles change over time[6].</td></tr>
</table>

[3] See Hoverstadt for definitions of the macro "run the business" and "change the business" processes which he demonstrates exist in all organizations via the application of Stafford Beer's Viable Systems Model (VSM) of the organization (Hoverstadt, 2008).

[4] This may be one reason Osterwalder had to reconceptualise the "Learning & Growth" balanced scorecard perspective, which does recognize the importance to firm survival of adaption through learning over time. Osterwalder renames this perspective "product" (see Table 7-3).

[5] By the definition of organizational sustainability adopted it is hard to conceive how many existing firms could become sustainable. Hence a sustainable business model must by definition include the possibility that a firm's stakeholders may choose to design an orderly 'wind-down' of a firm when it no longer meets any of their needs. Such a choice is based on the stakeholder's determination that their need for a sustainable future for themselves is best achieved without the firm remaining in existence.

[6] The structure of any ontology (its constructs and relationships), or any instantiation of that ontology, is static at the point in time at which it is created.

<table>
<tr><th>Design Principle Used to Identify Gap</th><th>Gap #11-12 Identified Between BMO and SSBMO Design Principles (Processes)</th></tr>
<tr><td>DDP3
DDP6</td><td>11. As Osterwalder does not conceive of a boundary to a firm nor a firm’s ultimate social and biophysical context, it assumes that any resources
– Required for the execution of the firm’s processes in order to generate the firm’s value propositions are acceptable, so long as they may be obtained at a monetary cost that enables a net monetary profit [Lawn].
– Generated intentionally (products, packaging) or as a bi-product (waste) by the execution of the firm’s processes in order to generate the firm’s value propositions are acceptable, so long as the firm may claim they no longer have ‘privileged access’ to those outputs at a monetary cost that enables a net monetary profit [Lawn, McDonough].
No consideration is possible for any limitations on the ultimate biophysical stocks (sources and sinks) of all resources a firm requires or generates, nor of any social costs involved in obtaining, moving or transforming these resources (aka ‘externalities’) [Lawn, McDonough].</td></tr>
<tr><td>DDP6</td><td>12. As Osterwalder does not conceive of a boundary to a firm nor a firm’s ultimate social and biophysical context, it is assumed that any processes a firm needs to generate the value proposition are acceptable, so long as they may be executed legally and at a monetary cost that enables a net monetary profit [Lawn, McDonough].
No consideration is possible for any limitations imposed by or any impact on the eco-system services required by a firm’s processes without the firm incurring a monetary cost (aka ‘externalities’). Further no consideration of impact on other human or non-human users of those same eco-system services is possible [Lawn, McDonough].</td></tr>
<tr><th colspan="2">Proposed Resolution Four</th></tr>
<tr><td colspan="2">A strongly sustainable business model must consider the ultimate source and sink of all biophysical stocks to which a firm has ‘privileged access’ that are moved or transformed by the firms processes: from those the firm takes legal ownership over, to those which the firm merely controls during the execution of its processes (e.g. atmospheric oxygen used in processes requiring combustion – such as internal combustion engine powered transportation).
A strongly sustainable business model must consider the flows from and impacts on all eco-system services upon which the firm’s processes depend (e.g. climate regulation as a result of creating carbon dioxide in fossil fuelled transportation processes).</td></tr>
</table>

This is true even if the instantiation contains descriptions of business processes that would (once executing) lead to a different business model being more representative of the new reality so created.

Explicating: The specifics of any change to an instantiation of an ontology cannot be predicted (this would be prediction of an unknowable future) and hence it cannot be described in any business model. However, a strongly sustainable business model ontology can describe a business model design that conceptualized **how** such changes might happen. i.e. the ontology can allow descriptions of organizational change processes, such as conceptions of the processes required to create a “learning organization” (Senge, 1990). These would cause the organization to continuously learn and adapt. This might increase the likelihood of organizational resilience and sustainability. In turn the execution of such processes over time would require the instantiation of the business model ontology to be revised to represent the new reality.

Design Principle Used to Identify Gap	Gap #13 Identified Between BMO and SSBMO Design Principles (Modelling)
DDP1	13. The capture and coding of Osterwalder's ontology does not consistently follow the entity relationship modelling formalism. No single detailed diagram of the BMO is provided only a summary (SM1 is adapted from Osterwalder, 2004a, p. 44). Further its diagrammatic formalism does not consistently use entity relationship diagrammatic notation and conventions. – Entities are referred to as elements and sub-elements. The theoretical basis for this is unclear (Osterwalder, 2004a, p.47). – Not all concepts are described as entities, e.g. the "building blocks" and the Balanced Scorecard Perspectives are not defined in the modelling and diagrammatic formalism. – There are inconsistencies between the inclusion of elements in the detailed and summary views, e.g. the profit element appears on most summary diagrams but not in the detailed diagrams and descriptions. – Descriptions of relationships between elements are not consistently described using the entity relationship modelling formalism. Object oriented programming conceptions of inheritance and / or set theory are introduced, i.e. between the elements in each of the nine "building blocks". However this is not explicitly explained nor consistently applied[7]. – There are inconsistencies within the description of relationships. Many relationships appear, based on 'common sense' reading, to require many-to-many cardinalities, but generally only one end of such relationships is described. – No standard is used for the description of attributes. The partial use of the object oriented conceptions of inheritance is sometimes (implicitly) used to justify the omission of the description of attributes of a 'super-class' element. – Some elements do not have attributes labelled as the identifier of an entity's instances (i.e. attributes identified as keys are missing); some elements do not have attributes that describe an instance of an entity (i.e. a name or description attribute is missing). – Numerous (small) inconsistencies between diagrams and textual descriptions (Listed in 7.8).

[7] Implicitly it is clear Osterwalder introduced these ideas as they made some aspects of achieving the goal of exploring computerized business modelling tools based on the BMO easier. However, since Osterwalder's model is largely based on the entity relationship formalism relationship, not following a single formalism seems an unnecessary, albeit fashionable complication.

Design Principle Used to Identify Gap	Gap #13 Identified Between BMO and SSBMO Design Principles (Modelling)
Proposed Resolution Five	
A single detailed diagram of the BMO is developed from the text of Osterwalder's work (SM2)[8]. The strongly sustainable business model ontology and all the concepts within it are captured using the textual Entity Relationship Modelling formalism (ERM) and visually coded using the Entity Relationship Diagramming (ERD) formalism, as described in 5.4.3 and 5.4.4. Specifically, generalization entities will be used to describe the Balanced Scorecard Perspectives and the environmental, social and economics context for an organization. All relationships between all concepts are described using entity inter-relationships, including sub-type, super-type relationships.	

Table 7-2: BMO Gap Analysis and Proposed Resolution Design

The next section, 7.2.1.2, records how changes made to the BMO to arrive at the SSBMO were documented and tracked.

Section 7.2.1.3 reflects on the gap analysis and the five proposed resolutions (Table 7-2), leading to the identification of a key design challenge for the SSBMO: increased conceptual complexity. A possible approach to surmount the challenge is discussed.

Sections 7.2.1.4-7.2.1.7 introduce and summarize all the changes made to the BMO to arrive at the SSBMO, highlighting which ontology Overall and Detailed Design Principles are adhered to in each case. This provides traceability to the supporting literature (Chapters 3 and 4).

The details of the SSBMO design and the details of the justification for the choices made to adhere to the ontology Overall, Detailed Design and Build Principles are then presented in sections 7.3 and 7.4.

[8] It was during the development of this single detailed diagrammatic view of the BMO that the inconsistencies identified in the textual description of the BMO became apparent. These are documented in 7.8. That such inconsistencies exist is odd given one of Osterwalder's stated intentions is to create computerized tools from the BMO; such tools require a consistent logical formalism in order to work.

7.2.1.2 Recording / Tracking Changes to the BMO

A side-by-side comparison of each entity and relationship within the BMO and SSBMO was prepared during activity groups D1-2. See Working Paper #1, available upon request (~85 pages). This acts as an audit trail / change log.

7.2.1.3 Reflection on Overall Rationale for Changes to the BMO

Reflecting on the first working hypothesis (WH1 whether it is possible to create a useful model of a strongly sustainable business based on existing knowledge) in light of the identified gaps and possible resolution designs as they were developed during build activity groups D1 (Table 7-2) led to a better understanding of the challenges of creating a strongly sustainable business model ontology. In addition to shaping the design of the SSBMO and SSBMC this reflection also influenced the way a number of the Preparation activity groups were designed and executed (Chapter 4) and how this document was structured (II-3).

From the gap analysis it becomes very apparent just how embedded Osterwalder's Business Model Ontology is within the "machine age" "normal science" paradigms of neo-classical managerial and organizational micro-social science and neo-classical micro-economics as understood at the end of the late 20th and start of the 21st century C.E. (Ackoff, 1974; Kuhn, 1996). As primary evidence for this conclusion consider how in the BMO the firm and its business model is considered purely by analysis as a set of parts largely in isolation from society, and in total isolation from the bio-physical environment. Such context would only be discoverable through the application of "systems age" synthesis to complement the "machine age" analytical frame. This supports the identification of the profit-first approach as an "overriding but implicit normative assumption" in Osterwalder's work, and the key gap for this research to address (2.1).

As demonstrated by the number and diverse nature of the works reviewed in Chapters 3 and 4 the concept of strong sustainability, as it applies to organizational design, is considerably more complex than a 'simple' monetarily profitable organization.

Hence, as per Ashby's Law of Requisite Variety (Ashby, 1958), it should be unsurprising that any attempt at providing an ontology for strongly sustainable organizations will necessarily be more complex than an ontology that is attempting to model 'only' a monetarily profitable business.

For example, gaps 1-3, based on the "paradigm changing" (Kuhn, 1996) ecological macro- and micro- sociological and economic literature reviewed, suggests that any business model ontology that has the goal of being able to describe a strongly sustainable firm, must include all the firm's contexts as first order constructs. In turn this creates a necessary and considerable increase in the complexity of the required ontology system.

The nature of an evolution of a system's complexity in response to a changed context (i.e. the evolution of the business model ontology system to fully include firm context) is predicted by another group of paradigm changers: the ecological systems thinkers. These scholars describe the expected increase in complexity as an elaboration of both the differentiation and integration within the system. This is contrasted with an elaboration of a system within the same context which 'only' results in an increase in system complication (Allen, Tainter, & Hoekstra, 1999; Gharajedaghi, 2011).

Four implications (and their permutations) for the utility of the SSBMO, which its increased complexity over the BMO due to its changed context, thus appear possible:

1. Users are able to handle the cognitive load of the additional complexity.
2. The additional integration and differentiation within the SSBMO enables users to change focus, ignoring now irrelevant complications that appeared in the BMO; hence the net cognitive load in using the SSBMO and the SSBMC it powers, remains unchanged compared to the BMO and the BMC it powers.
3. The visually simplified design tool powered by the SSBMO, the SSBMC, is able to help users overcome any additional cognitive load.
4. Users are unable to make use of the SSBMO and the SSBMC it powers due to the increase in complexity.

The likelihood that possibilities 2 and 3 may be achieved can be enhanced by making appropriate choices in the design of the SSBMO and SSBMC. The aim of such design is to make the inherent complexity comprehendible for users while not eliminating the additional constructs that are suggested to be required by the formal, natural and social science literature of organizational strong sustainability (Chapter 3 and 4, as captured in the design principles).

But how to conceive of such design choices? Ecological system thinkers Allen, Tainter, Hoekstra and organizational systems thinker Gharajedahi suggest that while a system reaching a significant new level of integration and differentiation clearly increases its total complexity, it may be possible for models of this system to be designed so that **model** complication does not increase, i.e. increases in systems complexity (differentiation and integration) will allow some existing system parts to be considered unimportant based on the purpose of the **model** of the system. Hence, in the **model**, representations of any such parts may become subsumed into other parts thereby reducing the complication in the revised model.

As an example: a world in which only many types of herbivores exist becomes more **complicated** when another species of herbivore evolves. However, it becomes more **complex** upon the evolution of the first carnivore. Within the system of animals the arrival of another herbivore does not change system integration or differentiation; it just adds diversity, hence complication. But differences within the system of animals only increases upon the evolution of the first carnivore, as these are clearly different from any number of herbivore species. Further the system of animals becomes more integrated with the arrival of the first carnivore: carnivores are entirely dependent on herbivores, whereas herbivores are (generally) independent of each other. A model of the world of herbivores and carnivores could be more complex than one which only describes a world which only has herbivores. But if the purpose of the model considers the details of each herbivore species unimportant a simplification in the model is possible even though it is modelling a more complex system (Example adapted from Allen et al., 1999, Fig. 17 p.413).

This is the intriguing possibility described in 2 above, and leads to a question:

> Whether a net simplification of some aspects of the BMO is a possibility? i.e. are there aspects of the BMO that are irrelevant complications from the perspective of the paradigm shifting science which informs the SSBMO?

Humbly, the practical application of this insight to achieve a high level of artefact utility is acknowledged as the major design challenge for the SSBMO and the SSBMC. In turn the identification of this design challenges and a possible approach to overcoming it informed the evaluation metrics chosen in Chapter 6. The chosen metrics specifically seek to gather feedback on the comprehendability aspect of utility.

Some early hints as to whether this challenge may have been overcome is suggested in 7.5.3 "Reflection on Utility Possibly Enabled by the SSBMC". Further evidence is suggested by the results of gathering the values of the evaluation metrics, described in Chapter 8, and the candidates for the improvement of the SSBMO and SSBMC, discussed in Chapter 9. Together these results start to indicate whether or not this design challenge was in fact overcome.

7.2.1.4 Summary of Additions to the BMO

Compared to the BMO, in the SSBMO:

3 nested generalization entities are added

7 entities are added to the existing 20 (including 1 'boundary' entity)

The BMO does not conceptualize that there is anything in a business model that is 'outside' the firm that might act as a constraint, i.e. the BMO assumes a business model is essentially context free; it gives no 'hints' to a business model designer on what context might be important[9]. The SSBMO adds a nested set of three generalization entities (DDP3, Environment, Society, and Monetary Economy).

Since the BMO does not include any context, the idea of the firm as a concept which acts as a 'boundary' to other concepts is not included in the BMO. The SSBMO adds a single firm 'boundary' entity (DDP3, Firm).

Considerable research by (profit-first) business model scholars has been completed since the BMO research was undertaken. Based on this research the SSBMO adds three entities (DDP5, Decision, Process Measure, and Asset).

Since the BMO is based on a profit-first world view concepts identified by the strongly sustainable literature are not included in the BMO. Based on this research three entities are added to create the SSBMO (DDP6, Biophysical Stock, Eco-system Service, and Need).

7.2.1.5 Summary of Changes to the BMO

> *Compared to the BMO, in the SSBMO:*
> *4 of 4 existing perspective pillars are changed to generalization entities*
> *(2 of these perspective entities are sub-typed)*
> *5 of 20 existing elements are reconceptualised as entities*
> *4 of 20 existing element definitions are significantly extended in identically named entities*
> *1 of 20 existing element names is renamed in its corresponding entity*
> *The remaining 10 element definitions and relationships are aligned to their corresponding entities with the definitions and relationships of all the new / changed entities*

The BMO conceives of the four Perspectives from the well known strategic execution alignment and measurement tool, the Balanced Scorecard (Kaplan, 1996). However, these

[9] Osterwalder's popular work does provide some limited advice on some aspects of context largely derived from Porter's Five Forces Model (Osterwalder & Pigneur, 2009, pp.200-211; Porter, 1985)

are not formally defined as entities as per the modelling formalism. Instead, without explanation Osterwalder refers to these as “pillars” (Osterwalder, 2004a, p.42).

For reasons that are unclear, Osterwalder chose to subtly rename these pillars from the work that inspired them. Further, based on the literature from the strongly sustainable world-view, the conceptual scope of the original four Balanced Scorecard perspectives is too narrow (DDP6).

The well-known Balanced Scorecard extensions to accommodate ideas of sustainability, the Sustainability Balanced Scorecard (Figge, Hahn, Schaltegger, & Wagner, 2002), were considered. These extensions are based on an ecological modernist / weak-sustainability world-view, and hence found not to be a valid approach for the SSBMO (ODP1).

Table 7-3 illustrates the changes made to the Balanced Scorecard perspectives as used by Osterwalder to create the six perspectives generalization entities as used in the SSBMO. The justification for the choice of perspective labels and their definitions used in the SSBMO is provided in 7.3.3.

Label	**“Perspectives” As Originally Conceived** (Kaplan, 1996)	**Names of “Pillars” As Used by Osterwalder in BMO** (Osterwalder, 2004a, Table 15 p.43)	**“Perspective Generalization Entities” As Used in SSBMO**
A	Financial	Financial Aspects	Measurement
B	Customer	Customer Interface	Stakeholder (Includes sub-perspective Firm Stakeholders)
C	Internal Processes	Infrastructure	Process (Includes sub-perspective Firm Processes)
D	Learning & Growth	Product	Product, Learning & Development

Table 7-3: Balanced Scorecard Perspectives Labels Comparison

The sequence of the Perspectives was taken in Kaplan's original work to be critical to the 'logical flow' of the Balanced Scorecard, i.e. Financial results were the primary objective and hence customer perspectives must be aligned with these; results of executing processes were required to be aligned with customer requirements etc. Osterwalder makes a similar case in his work.

However, Osterwalder, citing works from the management and organizational sub-discipline of Entrepreneurship, thought that financial aspects of a firm were the result or measure of whether or not a firm's products had value propositions of interest to the firm's customers. Hence Osterwalder swapped Product (his label for the Learning & Growth perspective) with the Financial perspective.

Table 7-4 shows the sequence in which the perspectives were presented in the original work, in the BMO and in the SSBMO.

Sequence as Originally Conceived (Kaplan, 1996)	**Sequence as Used by Osterwalder in BMO** (Osterwalder, 2004a)	**Sequence as Used in SSBMO**
A	D	B
B	B	D
C	C	C
D	A	A

Table 7-4: Balanced Scorecard Perspectives Presentation Sequence Comparison

The justification for the sequence of presentation used in the SSBMO is provided in 7.2.2 and 7.3.3.1-7.3.3.2.

The BMO groups nine pairs (18) of its twenty elements into "building blocks" (See Table 4-10 and Osterwalder, 2004a, pp.42-44): The Profit and Actor entities are left outside any building block. Each building block is related to one of the four pillars. These nine building blocks are the only constructs shown in the BMC visual design tool powered by the BMO.

In the SSBMO, following the modelling formalism, 16 of the 27 entities are considered to have summary / detailed relationships. This summary / detailed relationship captures the same relationship between each of the pair of elements in each BMO building block.

Further, in the SSBMO, following the modelling formalism, 26 of the 27 entities are considered specifications of one of the added perspective generalization entities (The Firm specific entity is, by definition of being a boundary, outside the perspectives). Diagrammatically these 26 specific entities are shown within one of the perspective generalization entities (SM3 & 4).

The idea of grouping entities together to create the SSBMC simplified visual design tool powered by the SSBMO is retained (7.5).

Since the BMO is based on a profit-first world view, five entities identified by the strongly sustainable literature are only partially conceptualized in the entities in the BMO. These five entities are redefined to create the SSBMO (DDP6, Target Customer is changed to Target Stakeholder, Profit is changed to Tri-Profit, Revenue Model is changed to Revenue, Cost Structure to Cost and Revenue Stream and Pricing is changed to Valuation Method).

Further:

- The strongly sustainable literature suggests that definitions of four entities used in the BMO are materially incomplete (DDP6, Value Proposition, Actor, Resource and Activity), and one attribute is missed from all entities (DDP6, Geographic Location / Locality).
- One entity (relationship Mechanism) was felt to have been poorly named based on the description provided by Osterwalder. The name was changed to relationship Function to better reflect the description provided by Osterwalder[10].

Finally, these additions and changes cause the definitions and relationships of the 10 remaining elements to be revised to ensure consistency and compatibility (Criterion,

[10] The poor choice of name could be the result of English not being Osterwalder's first language.

Relationship, Channel, Link, Offering, Partnership, Agreement, Capability, Value Configuration, and Account).

7.2.1.6 Summary of Deletions from the BMO

No concepts, relationships or attributes were removed from the BMO to create the SSBMO. This is a significant reason for asserting that the SSBMO (and the SSBMC it powers) has the same capabilities to describe (and design) profit-first business models as the BMO (and the BMC it powers) (ODP2 and BP1).

7.2.1.7 Summary of all Differences between BMO and SSBMO

Table 7-5 quantifies all the differences between the BMO and SSBMO. Similar modelling concepts are grouped and separated by a dotted line. Different modelling concepts are separated from each other by a solid line. An empty cell indicates that the modelling concept label changes between the BMO and SSBMO (largely because the SSBMO attempts to strictly follow ERM terminology 5.4.3, 5.4.4).

Modelling Formalism Concept Label	BMO	SSBMO
Pillars	4	
Generalization Entities		9 (1 nested group of 3; 1 set of 6 with 2 nested)
Building Blocks	9[11]	
Summary / Detailed Specific Entity Relationships		8
Elements	20 (9 elements with 9 matching sub-elements; 2 other elements)	
Specific Entities		27
Total Constructs	33	36
Specifically Identified Attributes	38	128 [12]
Relationships	44 [13]	191 [14]

Table 7-5: Quantification of Differences between BMO and SSBMO[15]

Table 7-6 summarizes all the differences between the concepts in the BMO and SSBMO. It also notes which detailed design principle drives each change and references the section of this Chapter that provides the full description of each SSBMO entity. For a detailed comparison of each entity in the BMO and SSBMO please see Working Paper #1 (7.2.1.2).

[11] Building blocks are counted as constructs in the BMO; the summary / detailed relationships, being relationships, are not counted as constructs in the SSBMO.
[12] Osterwalder due to his use of the concept of inheritance between many elements does not feel the need to explicitly define most attributes for most elements. The SSBMO's strict use of the ERM formalism requires the explicit capture and coding of all attributes. This makes up the bulk of the difference in numbers of attributes
[13] Relational and inheritance relationships.
[14] Counting only the relationships of the specific entities provides better comparison of the BMO and SSBMO, since the BMO has no generalization entities. The number of relationships between the specific entities of the SSBMO is 62 (cv. 44 for the BMO). The remaining 129 are the large numbers of relationships between each of the generalized entities and the specific entities.
[15] Table 7-76 includes a summary of the differences between the BMC and SSBMC.

Label	**SSBMO Entity Name** (BMO Name, if different)	**BMO → SSBMO** (See Key Below)	**Primary SSBMO Detailed Design Principle**	**Full Description Reference** (BMO Full Description Reference, if applicable)
E S M	Environment, Society, Monetary Economy	✘ ✓	DDP3	7.3.2 Context Generalization
B D C A	Stakeholder & Firm Stakeholder (Customer Interface) Product, Learning & Development (Product) Process & Firm Process (Infrastructure) Measurement (Financial Aspects)	Δ	DDP3, DDP4	7.3.3 Perspective Generalization (Osterwalder, Table 15 p.43 & Product pp.48-49, Customer Interface pp.58-60, Infrastructure Management p.79, Financial Aspects p.95)
1	Firm	✘ ✓	DDP3, DDP6	7.4.2 Firm Entity
2	Actor	+	DDP5, DDP6	7.4.3.2 Actor (Table 30 p.80)
3	Need	✘ ✓	DDP6	7.4.3.3 Need
4	Target Stakeholder (Target Customer)	Δ	DDP5, DDP6	7.4.3.4 Target Stakeholder (Table 23 pp.60-61)
5	Criterion	—	DDP5	7.4.3.5 Criterion (Table 24 p.61)
6	Relationship	—	DDP5	7.4.3.6 Relationship (Table 27 pp.71-73)
7	Function (Mechanism)	↔ —	DDP5	7.4.3.7 Function (Table 28 pp.73-77)
8	Channel	—	DDP5	7.4.3.8 Channel (Table 25 p.63)
9	Link	—	DDP5	7.4.3.9 Link (Table 26 pp.64-67)
10	Value Proposition	+	DDP4, DDP5, DDP6	7.4.4.2 Value Proposition (Table 20 pp.49-50)
11	Offering	—	DDP5, DDP6	7.4.4.3 Offering (Table 21 pp.50-56)
14	Decision	✘ ✓	DDP5	7.4.5.2 Decision
12	Partnership	—	DDP5	7.4.5.3 Partnership (Table 34 pp.89-92)
13	Agreement	—	DDP5	7.4.5.4 Agreement (Table 35 pp.92-95)
15	Capability	—	DDP5	7.4.5.5 Capability (Table 29 pp.79-80)

Label	**SSBMO Entity Name** (BMO Name, if different)	**BMO → SSBMO** (See Key Below)	**Primary SSBMO Detailed Design Principle**	**Full Description Reference** (BMO Full Description Reference, if applicable)
16	Resource	+	DDP5, DDP6	7.4.5.6 Resource (Table 31 pp.81-83)
17	Biophysical Stock	✘ ✓	DDP3, DDP6	7.4.5.7 Bio-Physical Stock
18	Value Configuration	—	DDP5	7.4.5.8 Value Configuration (Table 32 pp.83-84)
19	Activity	+	DDP5, DDP6	7.4.5.9 Activity (Table 33 pp.84-87)
20	Eco-system Services	✘ ✓	DDP3, DDP6	7.4.5.10 Eco-System Service
21	Valuation Method (Revenue Strategy and Pricing)	Δ	DDP5, DDP6	7.4.6.2 Valuation Method (Table 37 pp.96-101)
22	Tri-Profit (Profit)	Δ	DDP5, DDP6	7.4.6.3 Tri-Profit (Figure 49, p.95)
23	Account	—	DDP5	7.4.6.4 Account (Table 40 p.102)
24	Process Measure	✘ ✓	DDP5	7.4.6.5 Process
25	Revenue (Revenue Model)	Δ	DDP5, DDP6	7.4.6.6 Revenue (Table 36 pp.95-96)
26	Cost (Cost Structure)	+	DDP5, DDP6	7.4.6.7 Cost (Table 39 pp.101-102)
27	Asset	✘ ✓	DDP5, DDP6	7.4.6.8 Asset

Table 7-6: Enumeration of Differences between BMO and SSBMO

Key for Table 7-6			
—	Corresponding entity appears in BMO; entity in SSBMO is changed only so as to be compatible with other additions and changes	✘	Entity Does Not Appear in BMO
✓	Entity Appears in SSBMO	↔	Entity Renamed in SSBMO
Δ	Entity Reconceptualised in SSBMO	+	Entity Definition Extended in SSBMO

7.2.2 Definition Description

As described in ontology Definition Description and Capture (5.4.3) a concise definition (capture) of each entity and its inter-relationships with other entities is provided based on the Entity Relationship Modelling formalism. This is achieved by presenting each entity using the structure shown in Table 7-7. The format of the entries in this table uses the Backus-Naur Form grammar (BNF) (See 5.4.4 and Part V Annotated Glossary for a description of this grammar).

<table>
<tr><th>Name</th><th>[“Generalization” | “(“ <Related Entity Name> “)”] <Entity Name (Noun, capitalized first letter)>*</th></tr>
<tr><td>Definition</td><td><A concise description of the concept that this entity models>
[{<If specific instances or types of instances of the entity are mandatory then these are described “<Specific Instance>” | <Instance Type> “=” <Description> > }]</td></tr>
<tr><td>Related to
(including cardinality of relationship)</td><td>{<A sentence that describes another entity to which this entity is directly related, and the nature of the relationship (<i>with the verb sentence part in italics</i>)> <Cardinality of this relationship “(“ <Minimum “0” | “1” | “n”> “,” <Maximum “0” | “1” | “n”> “)”> [“(“ <Comments on the relation in this san-serif font > “)”]}
[<For increased comprehension, examples of relationships between an entity and entities with which it has an indirect relationship may also be provided. These are in this san-serif font>]</td></tr>
<tr><td>Cardinality</td><td>{<Cardinality of instances of this entity in a business model <Minimum “0” | “1” | “n”> “,” <Maximum “0” | “1” | “n”> >}</td></tr>
<tr><td>Attributes</td><td>< For each attribute of this entity provide: <Attribute Name (Capitalized first letter)*> [“(Identifier)”] “=” <Possible Values in BNF format> [“(“ <Description of this attribute in this san-serif font > “)”]} ></td></tr>
<tr><td>References</td><td>{<Reference to section of Osterwalder’s PhD containing citations which justify inclusion of this entity in the BMO>}[16]
{<Reference to ontology Overall or Detailed Design Principle to which the inclusion in the SSBMO of this entity, its attributes and relationships adheres>}
{<References to supporting sections of this thesis, if more than one, most important reference is in bold>}
{<Citation to key or additional literature which supports the inclusion of this entity, its relationships and/or its attributes>}</td></tr>
</table>

* Entity and Attribute names are treated as proper nouns, i.e they have capitalized first letters.

Table 7-7: Structure of Concise Entity Description Capture

[16] Readers should also review the literature review provided by Osterwalder that provides overall justification for his choices of elements and their inter-relationships (Osterwalder, 2004a, pp.23-41).

Further details, justification, examples and discussion of each entity and instances of that entity is provided below each concise definition. For example, typically the question or topic that creating instances of an entity and its inter-relationships answers is provided (see 5.4.3)[17].

The nouns used to label the entities are chosen[18] with the intention of increasing SSBMO utility due to their common usage and hence familiarity to its users. However, in this description, where there was a corresponding element in the BMO (Table 7-6) it is assumed the reader is familiar with the original details, justification, examples and discussion. To assist the reader, a reference to the relevant section of the BMO description is also provided in the last row of each entity's concise entity description (Table 7-7).

In both the concise descriptions and any further detail, entity and attribute names are written as proper nouns, i.e they have capitalized first letters. This differentiates references to the concept the entity or attribute models (written as a noun) from references to the concept or instances of the concept as captured and coded by the modelling formalism (written as a proper noun).

In the concise description of the relationships between entities, entity names are left singular (in order to remain as generic as possible with respect to all possible instances of the two related entities). Entity names are generally not preceded by an article (the exception is reflexive relationships where 'another' is used to indicate an instance of an entity may not be related to itself). Modal auxiliary verbs are frequently omitted (may, sometimes, etc.) as cardinality of the relationship concisely captures and codes all valid possibilities.

To fully explore the possibilities of each relationship the reader is encouraged to read each relationship several times:

- Firstly, inserting the appropriate combinations of pluralisation, articles and auxiliary verbs based on its cardinality.

[17] Such question serve as 'help text' to assist business model designers to use the SSBMC (7.5)
[18] Or were chosen by Osterwalder in the cases of the entities whose labels are unchanged in the SSBMO from the BMO (Table 7-6).

- Secondly, considering combinations of instantiations of each entity based on their concise definitions.

For specific entities their relationships are described in the following order

- Generalized entity relationships (Context then Perspective)
- Specific entity relationships (Order based on reading the relationship lines connected to the entity on the detailed formalized diagram (SM4) in a clockwise order starting at 1 o'clock.)

The Entity Relationship Modelling formalism is an instance of a mathematical graph (5.4.4). Hence there is no conceptual starting point or sequence (actual or implied). However, any textual description of a graph (such as this chapter) is necessarily ordered.

This means the order of presentation is a designed element and may increase or decrease comprehension and hence utility (see 7.3.3.2 for the rationalization of the presentation order chosen for this chapter).

However, the unordered nature of the underlying formalism and the need for the definition and description of the entities in an ERM to be ordered means that ***any*** order chosen will necessarily require descriptions of each entity to refer to the definitions of other entities that have not yet been described (i.e. the instances of Table 7-7 necessarily contain forward and backward references). This is an unfortunate complication for the reader, but theoretically unavoidable (without a lot repetition).

Finally:

- Each entity and all its relationships are coded in the detailed formal diagrammatic representation (SM4) as described in the ontology Detailed Diagrammatic Formalism (5.4.4)
- Each entity and its key relationships are also shown in the summary diagrammatic representation (SM3) as described in the ontology Summary Visual Representation (5.4.5),

7.3 Generalization Entity Descriptions

7.3.1 Introduction

Scholars have long used various generalizations as part of various ontologies and taxonomies to help organize, structure and / or constrain the constructs within the scope of their research. In the SSBMO the generalization entities are used to help model the context for a firm (DDP2, DDP3) and provide a structure to help a business model designers use the SSBMO to describe business models (DDP1, DDP2).

- The former are known as Context generalization entities. There are three of these entities which contribute to the SSBMO's adherence to DDP2 and DDP3. They are described in 7.3.2
- The latter are known as Perspective generalization entities. There are six of these entities which contribute to the SSBMO adherence to DDP1 and DDP2. They are described in 7.3.3.

Generalization entities in the SSBMO have the relationship of being a conceptual part of, or having some connection to, or context for the specific entities they contain. This relationship may exist for all possible instances of the specific entity (i.e. the generalization relationship is mandatory), or only some sub-set (i.e. the generalization relationship is optional). Each specific or generalization entity may simultaneously have a generalization relationships with more than one other generalization entity (5.4.4).

These relationships all highlight boundaries (constraints, limitations) to the entity instances they generalize, or simply highlight a useful conceptual association between the concept of an entity and its generalization entity(s). Hence the generalization relationship does **not** define the specific entities it contains, merely that there is some important association between the conceptions of the specific entity and of the containing generalization entity.

Relationships between a generalization entity and the specifized entity(s) it contains are described as being of a *generalizes* nature. In the BNF grammar (See 5.4.4 and Part V Annotated Glossary):

- <a generalization entity> [“*sometimes*” | “*partially*”] “*provides*” | “*is the only*” “*context for*” | “*contains*” | “*constrains*” <instances of an entity it generalizes>

  Conversely

- <an entity> [“always” | “*sometimes*” | “*partially*”] “*occurs within the context of*” | “*is one part of*” | “*is constrained by*” <the containing generalization entity>.

Business model designers using the SSBMO to describe their current or desired business model will choose whether or not to recognize and enforce any relationship in the SSBMO as they create the instances of the entities they require to describe their business model (ODP2, 3.5.1.5 Achieving the Generic Benefits of Ontologies with the Sustainable Business Model Ontology). Typically business model designers, whose world-view allows them, will choose to recognize and enforce relationships as envisaged in the design of the SSBMO based on the literature of strong sustainability. They would not be expected to create instances of the generalized entity(s); rather they would use their understanding of the formal, natural and social science related to the generalization entity(s) and its relationship with the specific entity to inform their choices of specific entity instances required to describe their business model.

Hence generalized entities, while critical for **conceptualizing** the context for the specific entities within a business model are perhaps not of equal importance to them in **describing** a business model. Generalized entities may be thought of as providing guidance and direction (via the boundaries they impose and the formal, natural and social scientific knowledge upon which they are based). Generalization entities aid the business model designer using the SSBMO to understand and apply the richness and depth of the conception of the specific entities themselves. By providing boundaries the generalized entities enable enhanced creativity in designing instances of the specific entities. In turn this increases the likelihood for innovative strongly sustainable business models to be created (RO1, RO2)[19].

7.3.2 Context Generalization Entities

7.3.2.1 Introduction

As per DDP3, in order to have the possibility of designing a strongly sustainable business model it is important for the business model designer to understand how all the elements within their business model design relate to the context for their business model.

As per the literature reviewed the symbiotic context for all human organizations consists of the three related nested systems of the biophysical environment, human society, and the socially constructed monetary economy (a holon of systems, 3.5.2.3). As Willard has stated the reality is, to use a metaphor, that

> *Human society [is] a wholly owned subsidiary of the environment – without food, clean water, fresh air, fertile soil, and other natural resources, we are out of business. People in societies decide how they will exchange goods and services. That is they create their economic models and change them if they find they are not working to improve their quality of life. To add another metaphor: society is the dog and the economy is the tail, not vice versa* (Willard, 2012, p.9).

In the SSBMO these three systems are coded as three nested entities collectively known as the "context generalization" entities. They provide the key overall context for all the other entities, as befits the reality of the single finite planet upon which all life exists and upon which the survival and possibility for the flourishing of current life is uniquely and critically dependent.

[19] Creative professionals commonly believe it is the boundaries they choose that, through a hermeneutic process, inform the creative process (we choose our boundaries and those boundaries act back on us and choose our response e.g. 'creativity required to create a painting cannot happen without the limits imposed by the edge of the canvas' (3.2.3.2).

7.3.2.2 Environment (Physical, Chemical, Biological)

Name	Generalization Context Environment (Physical, Chemical, Biological)
Definition	The semi-open system of planet Earth – its function, structure, process and context[20]. The systems structure (i.e. all matter) consists of, starting from its centre, the: core, mantel, crust, troposphere, stratosphere, mesosphere, thermosphere, and exosphere. The lithosphere consists of the upper most solid portions of the mantel and crust. The biosphere (or ecosphere) consists of the zone in which life occurs. The processes (i.e. the interaction of the matter with all flows of energy[21]) consist of: the geologic, climate regulation, bio-diversity (life / ecologic systems), nitrogen cycling, phosphorus cycling, ozone regulation and maintenance, ocean pH regulation, freshwater cycling, land use, atmospheric aerosol assimilation, chemical pollution assimilation. The context for this system consists of the Moon[22], our nearest star, the sun, the solar system (other planets, asteroids, etc.), and the amazing and huge universe beyond.
Related to (including cardinality of relationship)	Environment *provides the context for* all other entities within the SSBMO (1,1) (35: 8 other generalization entities and 27 other entities) Of these, Environment *is the only context* for the Biophysical Stock and Eco-system Service entities (1,n) (2) Environment *has* a large number of mandatory many-to-many relationships with all other entities (1,n)
Cardinality	1, 1
Attributes	None specifically; implicitly any attribute of the biophysical environment thought to be relevant to the business model being described may be conceptualized including geo-spatial locations.

[20] As per 3.5.4.3. While the structure, process and context of this system are increasingly well understood, its function is still very much open for debate. Non-Equilibrium Thermodynamics suggests the function of all the systems on and within Planet Earth is to maximize the creation of entropy through the autopoietic elaboration of far from equilibrium homeostatic biophysical structure and process (4.4.3.2).

[21] i.e. very high quality (high exergy) solar energy flowing from the sun, relatively lower quality heat and kinetic energy stored within the Earth at the point of the Earth's formation, and relatively low quality Gravitational energy flowing between the Earth and other celestial bodies, all of which (ultimately) dissipates as low quality (high entropy) energy in space around the Earth.

[22] The moon is far from inconsequential to the flourishing of life and humans. In addition to tidal effects on water and the land, consider this recent headline: "Hurricane Sandy: Why Full Moon Makes 'Frankenstor' More Monstrous" (Drye, 2012).

Name	Generalization Context Environment (Physical, Chemical, Biological)
References	DDP2, **4.4.5**, 4.5.5, 4.6.5 DDP3, 4.4.3.2

Table 7-8: Context Generalization – Environment

Table 7-9 shows the aspects of a strongly sustainable business model that the Environment Context generalization entity enables the SSBMO to describe.

Strongly Sustainable Business Model Definition Aspect (DDP2, 3.5.1.5)	**Concepts within the Biophysical Environment that may be Described**
Who a firm does it to, for and with	Organisms and non-living matter in the environment, i.e. human and non-human actors.
What a firm does now and in the future	Changes to the environment that create and destroy value for stakeholders and actors.
How, where and with what does a firm do it	Physical, chemical and biological processes, including the eco-system services required for the transformation of biophysical materials; geo-spatial locations; all biophysical materials and energy flows required and transformed[23] by these processes.
How a firm determines and measures success	Definitions and measurements of success that include positive and / or negative impact on the biophysical environment (stocks and flows), including biophysical and physiological impacts on human and non-human actors[24].

Table 7-9: Strongly Sustainable Business Model Aspects Described by Environment Context Generalization Entity

[23] Thanks to Prof. Henry Kim, Schulich School of Business, York University who highlighted that biophysical stocks can neither be created nor destroyed and suggested the term "transformation". Face-to-face discussion Dec 7,2011.

[24] It is noted that much current biology recognizes that non-human animals may also experience positive and negative psychological and social impacts, e.g. pain, pleasure, stress, etc.

Figure 7-1 shows how the Environment context generalization entity is visualized in the SSBMO summary (SM3) and detailed formal diagrammatic representation (SM4). A light green-light blue shading is used, inspired by the colours in the biophysical environment of land, water and sky.

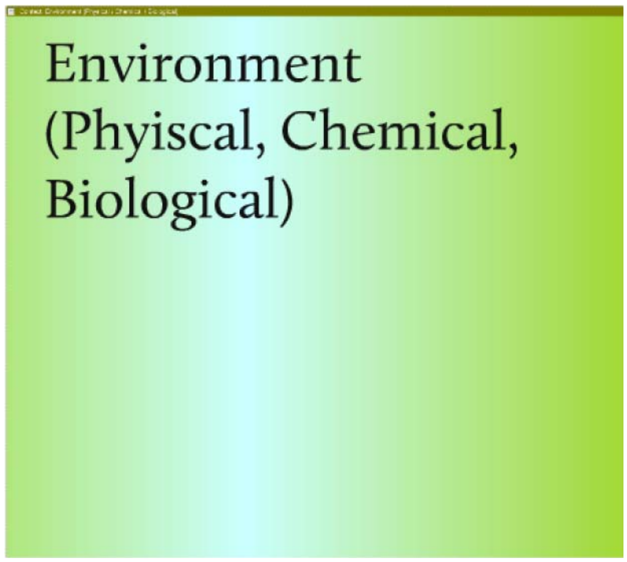


Figure 7-1: Context Generalization – Environment

7.3.2.3 Society (Social, Technological)

Name	Generalization Context Society (Social, Technological)
Definition	The semi-open system of human society – its function, structure, process and context[25]. The structure and processes include all socially constructed elements of human society: all human tacit and explicit knowledge, the technologies derived from and that contain this knowledge and all organizational / institutional structures and processes. The context for this system consists of the biophysical environment, upon which society and all its members are ultimately, intimately and entirely dependent.
Related to (including cardinality of relationship)	Environment Context generalization entity *provides the context for* the Society generalization entity (1,1) Society *provides the context for* the Financial Economy Context and Firm Stakeholder sub-Perspective generalization entities, the Firm, Target Stakeholder, Criterion, Relationship, Function, Channel, Link, Value Proposition, Offering, Decision, Partnership, Agreement, Capability, Resource, and Value Configuration entities (1,n) (17) Society *sometimes provides the context for* the remaining five Perspective generalization entities and the Actor, Need, Activity, Valuation Method, Tri-Profit, Account, Process Measure, Revenue, Cost, and Asset entities (0,n) (16) Society *has* a large number of mandatory and optional many-to-many relationships with these entities (1,n or 0,n)
Cardinality	1, 1
Attributes	None specifically; implicitly any attribute of society thought to be relevant to the business model being described may be conceptualized including geographical locations.
References	DDP2, **4.4.5**, 4.5.5, 4.6.5 DDP3, **4.4.3.3-4**, 4.4.4, 4.5.3.3-4, 4.5.4, 4.6.4.3-4, 4.6.4

Table 7-10: Context Generalization – Society

[25] As per 3.5.4.3. The structure and process of this system are (at best) only partially understood by sociology there being considerable debate between neo-classical macro-sociologies who believe, after Dirkheim that society is a closed system and the ecological (environmental) macro-sociologists who recognize the biophysical context for society (3.5.3.1 Macro-Sociology and 3.5.3.2 Micro-Sociology). Further the function of this system is hotly debated as illustrated by the divergence of the profit-first and strongly sustainable world views (4.4.3.3-4, 4.5.3.3-4, 4.6.3.3-4). Non-Equilibrium Thermodynamics suggests the function of all the systems on and within Planet Earth, including the system of human society is to maximize the creation of entropy through the autopoietic elaboration of far from equilibrium homeostatic social structure and process (4.4.3.2).

Table 7-11 shows the aspects of a strongly sustainable business model that the Society Context generalization entity enables the SSBMO to describe.

Strongly Sustainable Business Model Definition Aspect (DDP2, 3.5.1.5)	**Concepts within Human Society that may be Described**
Who a firm does it to, for and with	Human actors and stakeholders.
What a firm does now and in the future	Changes within and to society that create and destroy value for stakeholders and actors.
How, where and with what does a firm do it	Designs of human processes, including value configurations, partnerships and governance arrangements; geographical locations; all human mental effort and opinion, knowledge and technology.
How a firm determines and measures success	Definitions and measurements of success that include positive and / or negative impact on society, including psychological and social impacts on human actors.

Table 7-11: Strongly Sustainable Business Model Aspects Described by Society Context Generalization Entity

Figure 7-2 shows how the Society context generalization entity is visualized in the SSBMO summary (SM3) and detailed formal diagrammatic representation (SM4). A pink-light blue shading is used, inspired by the (bluish) red/pink colour of (un)oxygenated red blood cells of humans.

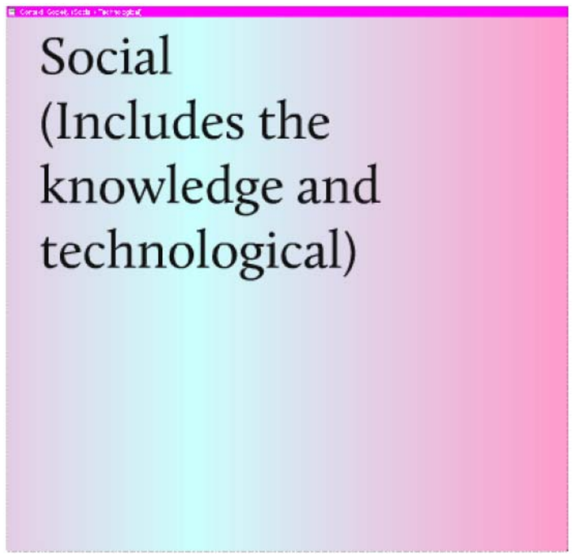


Figure 7-2: Context Generalization – Social

7.3.2.4 Financial Economy (Monetary)

Name	Generalization Context Financial Economy (Monetary)
Definition	The socially constructed semi-open system of the human financial economy – its function, structure, process and context[26]. The structure and processes includes all stocks of monetary units (in all forms, e.g. paper, electronic, etc.), all monetary unit creation events (e.g. 'printing', bank leverage, etc.), all pricing events (i.e. valuation in monetary units), and all flows of monetary units (transactions) between humans and human social constructions allowed to 'own' stocks of monetary units in any form (e.g. firms, governments, etc.). The context consists of human society and the biophysical environment. Members of society collectively create and manage the monetary economy to serve their goals. Since human society is contained within the biophysical environment, the monetary economy is also ultimately, intimately and entirely dependent upon it.
Related to (including cardinality of relationship)	Society Context generalization entity *provides the context for* the Financial Economy Context generalization entity (1,1) The Financial Economy *provides the context for* the Firm Process sub-Perspective generalization entity and the Target Stakeholder, Criterion, Relationship, Function, Channel, Link, Value Proposition, Offering, Partnership, Decision and Value Configuration entities (1,n) (12) The Financial Economy *sometimes provides the context for* the remaining five Perspective generalization entities and the Firm, Actor, Need, Agreement, Capability, Resource, Activity, Valuation Method, Tri-Profit, Account, Process Measure, Revenue, Cost, and Asset entities (0,n) (20) The Financial Economy *has* a large number of mandatory and optional many-to-many relationships with these entities (1,n or 0,n)
Cardinality	1, 1

[26] As per 3.5.4.3. The structure and process of this system are (at best) only partially understood by economics, there being considerable debate between neo-classical macro-economist who believe the economy is a closed system and ecological macro-economists who recognize the biophysical and social context for the monetary economy (3.5.3.1 Macro-Economics and 3.5.3.2 Micro-Economics). Further the function of this system is hotly debated as illustrated by the divergence of the profit-first and strongly sustainable world views (4.4.3.4., 4.4.4, 4.5.3.4, 4.5.4, 4.6.3.4., 4.6.4). Non-Equilibrium Thermodynamics suggests the function of all the systems on and within Planet Earth, including the socially constructed system of the financial economy, is to maximize the creation of entropy through the autopoietic elaboration of far from equilibrium homeostatic financial structure and process (4.4.3.2).

Name	Generalization Context Financial Economy (Monetary)
Attributes	None specifically; implicitly any attribute of the monetary economy thought to be relevant to the business model being described may be conceptualized, including locations of monetary units.
References	DDP2, **4.4.5**, 4.5.5, 4.6.5 DDP3, **4.4.3.4**, 4.4.4, 4.5.3.4, 4.5.4, 4.6.4.4, 4.6.4

Table 7-12: Context Generalization – Financial Economy

Table 7-13 shows the aspects of a strongly sustainable business model that the Financial Economy context generalization entity enables the SSBMO to describe.

Strongly Sustainable Business Model Definition Aspect (DDP2, 3.5.1.5)	**Concepts within the Financial Economy Entity that may be Described**
Who a firm does it to, for and with	Human stakeholders and actors; Human social constructions allowed to act as individual human stakeholders and actors in relation to monetary units.
What a firm does now and in the future	Changes to stocks of monetary units. Increases that create and decreases that destroy financial value for stakeholders and actors.
How, where and with what does a firm do it	Designs of financial processes, including those that create and change the privileged access to stocks of monetary units, the pricing of products and services, and the conduct of monetary transactions; locations of stocks of monetary units (e.g. bank accounts); all stocks of monetary units.
How a firm determines and measures success	Definitions and measurements of success that include positive and / or negative impact on stocks of monetary units.

Table 7-13: Strongly Sustainable Business Model Aspects Described by Financial Economy Context Generalization Entity

Figure 7-3 shows how the Financial Economy context generalization entity is visualized in the SSBMO summary (SM3) and detailed formal diagrammatic representation (SM4). A dark blue-light blue shading is used, inspired by the contradictory common ideas of a 'blue chip stock', conceived as a 'good' thing, and 'having the blues', conceived of as a 'bad' thing!

Figure 7-3: Context Generalization – Financial Economy

7.3.2.5 Nesting the Context Generalization

As described, the three contextual systems are nested within one another; i.e. the financial economy is wholly contained within the social, and in turn the social is wholly contained with the environment (both the former are totally dependent upon the latter).

Figure 7-4 shows how this can be visualized in three dimensions.

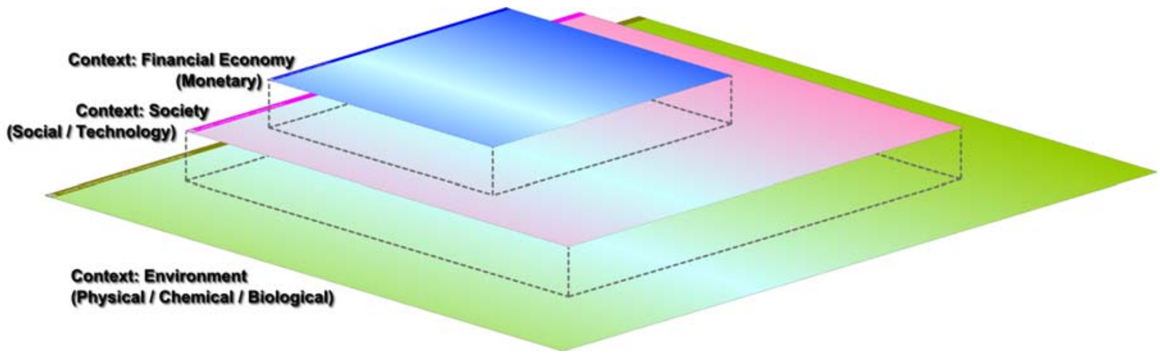


Figure 7-4: Context Generalization – Three Dimensional View

Figure 7-5 shows how, as per the diagrammatic formalism (5.4.4), in the summary and detailed formal diagrammatic representations of the SSBMO this three dimensional view is ‘flattened’ to a two dimensional representation (SM3, SM4), i.e. the three Context Generalization entities are coded as rectangles nested within one another.

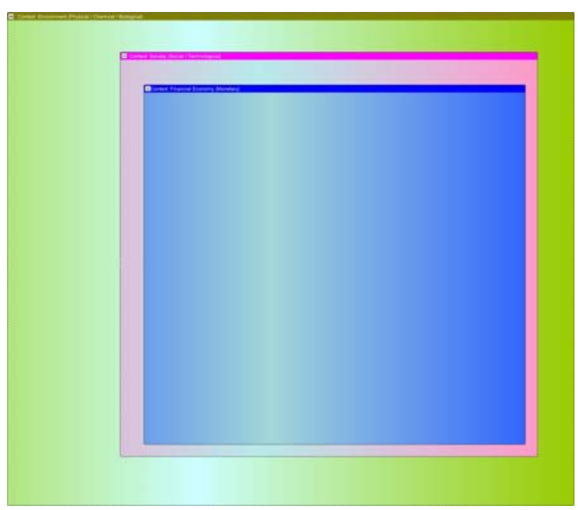


Figure 7-5: Context Generalization – Detailed and Summary View

Since all entities within the SSBMO other than Environment are contained by at least one of these context generalization entities, any instance of any entity (except the Environment) should be related to (constrained by) one or more aspects of one or more of these containing contexts. Whether or not a specific instance of an entity is related to the context generalization as suggested by the formal, natural and social science literature depends, as always, on the business model designer's world-view (ODP2).

In conventional profit-first terms most instances of most entities in the BMO have a strong financial context. This is implied by the unstated normative assumption in the profit-first inspired purpose of the BMO's conception of a business model (3.5.3.4). There is nothing in the BMO to proactively encourage business model designers to consider social or biophysical contexts. There is nothing explicitly preventing their consideration, but in practice, since there is no prompting mechanism in the BMO, and due to the strong social convention of the primacy of monetary profit making, non-financial contexts are unlikely to be considered by a user of the BMO unless such considerations help achieve increased monetary profitability (this lack of reliably considering context is a fundamental problem with believing weak sustainability approaches will enable sustainable outcomes i.e. Blattberg's pluralist profit-seeking paradox, 4.6.5.2).

By contrast, in the SSBMO **any** entity must (ultimately) have an environmental context. Entities that *only* have an environmental context, without any social or monetary aspects, are coded, as per the diagrammatic formalism (5.4.4), **entirely** inside the Environmental context generalization entity rectangle, and not overlapping any other context generalization entity (Figure 7-1)[27].

Entities which must (by definition) have an environmental context and whose instances

- *May have* other contexts are shown **overlapping** those other generalization context entity(s).
- *Must* or *will-always have* **additional** contexts are shown **entirely** inside those other generalization context entity(s).

[27] The two entities so coded are Bio-physical Stock and Eco-system Service. Since in the SSBMO the biophysical environment is conceptualized as the 'ultimate' context for any Earth-bound business model, no entities are coded 'outside' the Environment context generalization entity.

To illustrate: entities whose instances *must* have a social and / or financial context (and hence by definition they have some degree of reliance or connection to with the biophysical environment) are coded, as per the diagrammatic formalism, **entirely** inside the Social context generalization entity rectangle (Figure 7-2). Similarly some entities *must have* a financial economy context (and hence by definition they have some degree of reliance or connection to the social and biophysical environment). Entities that *must have* a financial economy context are coded, as per the diagrammatic formalism, **entirely** inside the Financial Economy context generalization entity rectangle (Figure 7-3).

Other entities, whose instances *may have* a social and / or financial context (but by definition will always have some degree of reliance or connection to with the biophysical environment) are coded, as per the diagrammatic formalism, **overlapping** the Social context generalization entity rectangle (Figure 7-2). Similarly some entities *may have* a financial economy context (and hence by definition they have some degree of reliance or connection to with the social and biophysical environment). Entities which *may have* a financial economy context are coded, as per the diagrammatic formalism, **overlapping** the Financial Economy context generalization entity rectangle (Figure 7-3).

For example the Activity entity is coded in the SSBMO entirely inside the Environmental context generalization entity, but overlapping both the Social and Financial Economy context generalization entities (SM4). This is because an activity within a firm may only have a biophysical aspect (e.g. a combustion event within an internal combustion engine). Alternatively an activity may be purely social (e.g. a meeting of humans), but ultimately this too depends for its success on aspects of the biophysical environment (e.g. food, clean air and water, etc.). Finally an activity may be purely financial (e.g. conducting a financial transaction), but this too ultimately depends for its success on aspects of both human society (i.e. trust in the monetary units) and the biophysical environment.

Many activities firms need to perform to create their value propositions have complex combinations of all three contexts, particularly at the high level of abstractions used in business modelling. For example a typical “top level process” (Figure 7-11) in a firm is the ‘order to cash’ process that involves social relationships (taking the order, managing the process of and actually making the product/service), environmental relationships (physically shipping the finished goods involving assets and processes which come from, depend upon, or are moved within the environment), and finally financial relationships (receiving payment).

Unlike the BMO, the SSBMO encourages a business model designer, if their world-view allows it, to explicitly consider all the relevant contexts to all aspects of their existing or desired business model. This capability of the SSBMO helps it adhere to ontology Overall and Detailed Design Principles ODP1 & 2, DDP2 and DDP3, and contributes to meeting RO1: if a business model designer is interested, it helps them ensure their business model designs reliably, consistently, effectively and explicitly leverage the formal, natural and social science of organizational strong sustainability (Chapter 3 and 4).

7.3.3 Perspective Generalization Entities

7.3.3.1 Introduction

As per RO1 & 2 and DDP1, in order to create an artefact of high utility for the design of strongly sustainable business models it is important to provide the business model designer with hints as to the meanings and inter-relationships of the concepts involved in a business model (DDP2).

Providing visual hints for the intended use of an artefact is a well known and highly recommended technique to increase artefact utility (Norman, 1990, first published 1988, pp.13-33).

The Perspective generalization entities contribute to the ‘hinting’ function in the SSBMO. The Perspective generalization entities respectively represent the four well known Balanced Scorecard Perspectives (Financial, Customer, Internal Processes, and Learning & Growth). These are believed to be the necessary and sufficient aspects of a firm that must be considered of equal importance, albeit in a specific order, so that the successful execution of a firm’s strategy may be achieved (Kaplan, 1996).

This conception of the Perspective generalization entities enables them to provide important hints to a business model designer on the definitions of and inter-relationships between the specific entities contained by each Perspective generalization entity. Every specific entity in the SSBMO, except Firm, is contained within one of the Perspective generalization entities (26). The Firm entity is not contained by any of the Perspective generalization entities by definition: the Balanced Scorecard Perspectives are concepts of aspects of firms, and hence are within the conception of the Firm entity.

This same approach was adopted by Osterwalder in his use of the four "pillars" to group related entities in the BMO (7.2.1.5). Following Osterwalder's lead, and as introduced in Table 7-3, the SSBMO has adapted the Balanced Scorecard Perspectives.

However, adaptation was necessary: the Balanced Scorecard was conceived entirely within the profit-first world-view. However, the SSBMO adaptations to the definitions of each perspective are explicitly additive. The revised concepts only serve to extend the scope of each perspective from its original Balanced Scorecard definition. This contributes to the SSBMO's adherence to ODP2 by being able to represent both profit-first and strongly sustainable business models.

As with the Context generalization entities each Perspective generalization entity acts to highlight boundaries (constraints and limitations) to the specific entities it generalizes. Hence the perspective generalization relationship does **not** define the specific entities it contains, merely that there is important association between the conceptions of the specific entities and of the containing Perspective generalization entity.

As introduced in Table 7-3, in the SSBMO the six perspective generalization entities are labelled:

1. Measurement
2. Stakeholder
3. Sub-perspective Firm Stakeholder
4. Process
5. Sub-perspective Firm Process
6. Product, Learning & Development

By adding the two sub-perspectives, unlike the BMO, the SSBMO encourages a business model designer, if their world-view allows it, to explicitly consider the relevant contexts for the stakeholders and processes in their existing and desired business model. This capability of the SSBMO helps it adhere to ontology Overall and Detailed Design Principles ODP1 & 2, DDP2 and DDP3, and contributes to meeting RO1.

The definitions of each perspective are given in 7.3.3.4-7.3.3.7, along with the explanation and justification of the revisions to their conceptualization from the original Balanced Scorecard.

7.3.3.2 Perspective Generalization Entity Presentation Sequence

As introduced in Table 7-4, the SSBMO also adapted the Balanced Scorecard Perspectives presentation sequence from the original and the sequenced used to describe the BMO.

In a strongly sustainable business model monetary measures are just one part of the definition and measurement of organizational success. Hence the SSBMO concurs with Osterwalder's assertion that (financial) measurement is in general terms to be considered after other perspectives (7.2.1.5)[28].

[28] Of course in terms of the sequence of steps to be taken when designing a business model, it is commonly recommended that a business model designer considers the mission, vision and values of a firm (i.e. the

However, the organizational strong sustainability literature, by conceiving of firms as socially constructed, suggests that a firm's stakeholders and their needs (including customers) are of paramount importance. A firm's value propositions (the BMO Product pillar) are an expression of a firm's intention of creating or destroying stakeholder value. Hence in the SSBMO, unlike in the BMO, stakeholders and their needs must clearly be considered, in general terms, before considering all other perspectives.

Hence as introduced in Table 7-4, in this chapter the six perspective generalization entities and the specific entities they contain are described in the following order:

1. Stakeholder
2. sub-perspective Firm Stakeholder
3. Product, Learning & Development
4. Process
5. sub-perspective Firm Process
6. Measurement

On the summary and formal diagrammatic representations (SM3 and SM4) this sequence is followed by reading the Perspective generalization entities, starting in the Top Right in a Right to Left ***then*** Top to Bottom order.

7.3.3.3 Perspective Generalization Entity Summary

Figure 7-6 shows how the six Perspective generalization entities are visualized in the SSBMO detailed formal diagrammatic representation (SM4). This figure also shows the aspects of the strongly sustainable business model definition that each Perspective generalization entity enables the SSBMO to describe (DDP2, 3.5.1.5).

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definition of success) before considering other perspectives (Tenner & DeToro, 1997, pp.21-36). But all design is iterative, so the idea that measurement is done after 'planning' and 'doing' and before 'acting' as the 'check' step in the macro continuous improvement process (Deming, 1986) justifies the description of measurement after the other perspectives herein.

Each Perspective generalization entity is filled by colours felt to be visually contrasting but complementary to the colours chosen for the Context generalization entities (DDP1, CDP2):

1. Stakeholder (Firm Stakeholder) – orange/yellow-light blue shading

2. Product, Learning & Development – light blue-white shading

3. Process (Firm Process) – mauve-light blue shading

4. Measurement – dark green-light blue shading

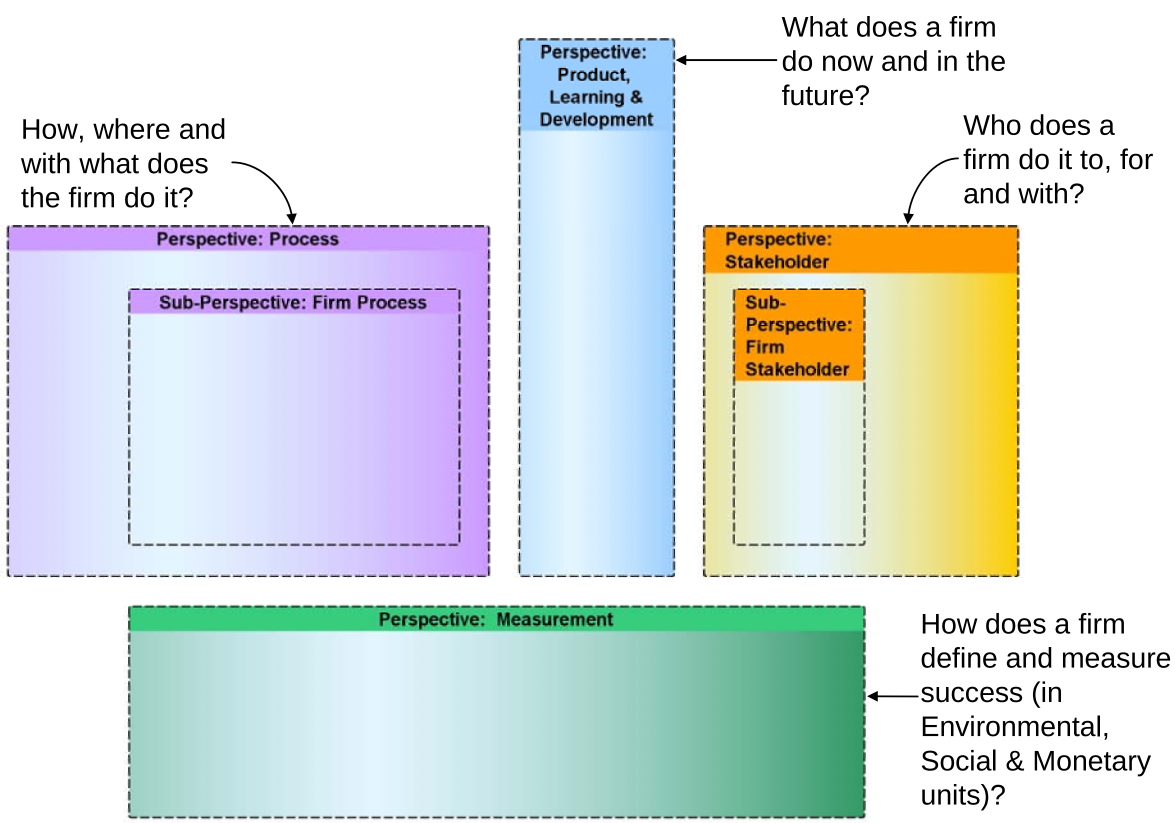

Figure 7-6: Perspective Generalization – Mapping to Strongly Sustainable Business Model Definition Aspects

7.3.3.4 Stakeholder

Name	Generalization Perspective Stakeholder
Definition	The concerns of the relationships of human and non-human actors and their needs with ideal seeking multi-minded purposeful systems.
Related to **(including cardinality of relationship)**	Stakeholder *is constrained by* Environment (1,1) Stakeholder *partially occurs within the context of* Society (0,1) and Financial Economy (0,1) Stakeholder *provides the context for* the Firm Stakeholder sub-Perspective generalization entity (and the six entities it contains), and the Actor and Need entities (1,n) (3). Stakeholder *has* a large number of mandatory and optional many-to-many relationships with these entities (1,n or 0,n).
Cardinality	1,1
Attributes	None specifically; implicitly any attribute related to the concept of stakeholders thought to be relevant to the business model being described may be conceptualized, including location.
References	DDP1, 4.4.2 DDP2, **4.4.5**, 4.5.5, 4.6.5 DDP3, **4.4.3.4**, 4.4.4, 4.5.3.4, 4.5.4, 4.6.4.4, 4.6.4 DDP5, 4.5.5.7 DDP6, 4.6.5.4

Table 7-14: Perspective Generalization – Stakeholder

Unlike the BMO, the SSBMO encourages a business model designer, if their world-view allows it, to explicitly consider all the needs of all possible actors now and in the future. Further it suggests they explicitly consider who their stakeholders may be, i.e. the legitimized or impactful stakeholder actors:

1. The firm may wish to legitimize
2. May choose to impact the firm (positively or negatively), and / or

3. May be impacted (positively or negatively) by the existence of a firm and its operations.

The works which support the validity of DDP5 and DDP6 justify the change in name of the profit-first Balanced Scorecard Customer Perspective to the strongly sustainable Stakeholder Perspective.

This capability of the SSBMO helps it adhere to ontology Overall and Detailed Design Principles ODP1 & 2, DDP1 thru 3 and DD5 thru 6, and contributes to meeting RO1: if a business model designer is interested, it helps them ensure their business model design consistently and explicitly leverages the literatures understanding of the importance of all human and non-human stakeholders in a strongly sustainable business model.

Sub-Perspective: Firm Stakeholder

Name	Generalization Sub-Perspective Firm Stakeholder
Definition	The concerns of the relationships of the legitimized or impactful actors (i.e. stakeholders) and their needs with a specific ideal seeking multi-minded purposeful system (i.e. a human organization).
Related to (including cardinality of relationship)	Firm Stakeholder *is constrained by* Environment (1,1), and *occurs within the context of* Society (1,1) and Financial Economy (1,1) Stakeholder Perspective *provides additional context for* the Firm Stakeholder Sub-Perspective (1,n) Firm Stakeholder *provides the context for* the Target Stakeholder, Criterion, Relationship, Function, Channel and Link entities (1,n) (6) Firm Stakeholder *has* a large number of mandatory and optional many-to-many relationships with these entities (0,n or 1,n) Firm Stakeholder *exists* for each Firm in a business model (1,1)
Cardinality	1,n
Attributes	None specifically; implicitly any attribute related to the concept of organizations' legitimized or impactful stakeholders thought to be relevant to the business model being described may be conceptualized, including location.
References	DDP1, 4.4.2 DDP2, **4.4.5**, 4.5.5, 4.6.5 DDP3, **4.4.3.4**, 4.4.4, 4.5.3.4, 4.5.4, 4.6.4.4, 4.6.4 DDP5, 4.5.5.7

Table 7-15: Sub-Perspective Generalization – Firm Stakeholder

7.3.3.5 Product, Learning & Development

Name	Generalization Perspective Product, Learning & Development
Definition	The concerns ● Related to the current and future value that ideal seeking multi-minded purposeful systems will create and destroy for their stakeholders. ● Of human and non-human actors' needs and their relationships with ideal seeking multi-minded purposeful systems. This describes the understanding of the value that a specific organizations' stakeholder actors want or do not want to receive related to products (including services), learning (of all types, including continuous improvement), and development (i.e. value related to the future existence of the system). Such descriptions are known as an organization's value propositions.
Related to (including cardinality of relationship)	Product, Learning & Development *is constrained by* Environment (1,1) Product, Learning & Development *partially occurs within the context of* Society (0,1) and Financial Economy (0,1) Product, Learning & Development *provides the context for* the Value Proposition and Offering entities (1,n) (2) Product, Learning & Development *has* a large number of mandatory and optional many-to-many relationships with these entities (1,n or 0,n) Product, Learning & Development *exists* for each Firm in a business model (1,1)
Cardinality	1,n
Attributes	None specifically; implicitly any attribute related to the concept of organizations' products, learning and development thought to be relevant to the business model being described may be conceptualized, including location.
References	DDP1, 4.4.2 DDP2, **4.4.5**, 4.5.5, 4.6.5 DDP3, **4.4.3.4**, 4.4.4, 4.5.3.4, 4.5.4, 4.6.4.4, 4.6.4 DDP4, **4.4.5.2**, 4.5.4.2, 4.6.5.2 DDP5,4.5.5.5, **4.5.5.7** DDP6, 4.6.5.4

Table 7-16: Perspective Generalization – Product, Learning & Development

The specific entities within the Product, Learning & Development gives the business model designer the opportunity to consider topics such as:

- What is required to create the most value for most stakeholder actors measured in environmental, social or economic units?
- How can value be created responsibly, environmentally, socially, fiduciarily (J. A. Brown & Forster, 2012; Doppelt, 2012)?
- How can shared value be maximized (Porter & Kramer, 2011)?
- How can socially desirable value (SDV) be maximized (Sawhney, 2011)?

The inclusion of “learning” by the original authors of the Balanced Scorecard was intended to convey how important improvement of existing products and services and the development of new products and services is for a firm to remain viable over time (Kaplan, 1996). This justifies its inclusion in the SSBMO. That products (and services) are a key type of value proposition required for a firm to remain viable over time justifies the inclusion of the word “product” in this strongly sustainable perspective.

The works which support the validity of DDP3 concerning the ultimate limits to growth on a finite planet, justify the change from the word “growth” in the original profit-first Balanced Scorecard Perspective to the use of the word “development” in the SSBMO.

Unlike the BMO, the SSBMO encourages a business model designer, if their world-view allows it, to explicitly consider their business model’s response to **all** the current **and** future needs of all possible legitimate or impactful stakeholder actors. This includes the value that a business model creates **and** destroys for an organization’s stakeholder actors.

This capability of the SSBMO helps it adhere to ontology Overall and Detailed Design Principles ODP1 & 2, and DDP1 thru 6, and contributes to meeting RO1: if a business model designer is interested, it helps them ensure their business model designs reliably, consistently, effectively and explicitly leverage the literatures understanding of the importance of both the positive and negative impacts of an organization (Chapters 3 and 4).

7.3.3.6 Process

Name	Generalization Perspective Process
Definition	The portion of the concerns related to the processes that ideal seeking multi-minded purposeful systems require to create and destroy value for human and non-human actors now and in the future. The processes describe all transformations, via the 'work'[29] that leads to the creation and destruction of value for its stakeholders, of: – Matter ("technical" and "bio-physical" "nutrients")[30] – Energy – Knowledge – Monetary units Hence the process perspective describes – All stocks of biophysical matter and energy before and after transformation – All flows of biophysical matter and energy during the transformations – "How Stuff Get's Done"[31]
Related to (including cardinality of relationship)	Process *is constrained by* Environment (1,1) Process *partially occurs within the context of* Society (0,1) and Financial Economy (0,1) Process *provides additional context for* the Firm Process sub-Perspective generalization entity (and the seven entities is contains), and the Bio-physical Stock and Eco-system Service entities (1,n) (3) Process *has* a large number of mandatory and optional many-to-many relationships with these entities (1,n or 0,n)
Cardinality	1,1
Attributes	None specifically; implicitly any attribute related to the concept of organizations' processes thought to be relevant to the business model being described may be conceptualized, including location.

[29] i.e. the transformation of high quality (high exergy) energy into low quality (high entropy) energy: physical (heat, beat), chemical (react, treat), biological (live, grow), etc.
[30] See 7.4.5.6 for definitions and references
[31] (Hammer, 1996)

Name	Generalization Perspective Process
References	DDP1, 4.4.2 DDP2, **4.4.5**, 4.5.5, 4.6.5 DDP4, **4.4.5.2**, 4.5.4.2, 4.6.5.2 DDP3, **4.4.3.4**, 4.4.4, 4.5.3.4, 4.5.4, 4.6.4.4, 4.6.4 DDP6, 4.6.5.5 (Hammer, 1996; McDonough & Braungart, 2002, pp.105-113; Upward, 2002)

Table 7-17: Perspective Generalization – Process

Unlike the BMO, the SSBMO definition of process is inclusive, based on situating organizational processes in their biophysical environmental, human social and monetary economic contexts. This includes all connections to **all** other human and non-human actors with which a firm is directly and indirectly connected (as per the definition of a strongly sustainable organization). Hence the firm is connected to **all** relevant flows and **all** ***ultimate*** sources and sinks of **all** relevant biophysical, social relationship and monetary units stocks. It explicitly extends an organization's business model beyond the monetary value system of the organizations with which a firm has direct financial dealings (typically the only boundary considered in profit-first business design).

Further, since Product, Learning & Development includes current and future value, the definition of Process must include the processes to both

- Run the business today, delivering current positive and negative value propositions

  and

- Change the business for tomorrow, delivering the future oriented value propositions.

The specific future needs of the stakeholder actors cannot be predicted. Hence all that may be known with confidence is that some stakeholder actors have a need for an organization to continue to exist and flourish over time. The processes which fulfill such value propositions are typically the processes that ensure the organization and all its stakeholders learn and continuously adapt.

As examples, at any point in time many

- Employee stakeholders have a desire to remain employees for long periods of time into the future.
- Customer stakeholders have a desire to be able to purchase spare parts, maintenance services and upgrades to existing products and services for long periods of time into the future.

Further unlike the BMO, the SSBMO encourages a business model designer, if their world-view allows it, to explicitly consider the environmental, social and monetary efficiency and effectiveness of all the processes required to deliver the value propositions, **and** the end-to-end impact of all the processes environmentally, socially and financially on all actors. These considerations, as per the literature, are recommended to be made irrespective of whether the processes are performed by the firm whose business model is being designed (the "focal firm"), or by organizations, individuals, non-human animals or eco-system services up or down the relevant cradle-to-cradle networks.

For a strongly sustainable business model designer this capability of the SSBMO helps to ensure that the moral obligations in the "Natural Laws of Sustainability" can all be considered and appropriately acted upon (4.6.3.3). It is these moral obligations, considered unusual, unnecessary or harmful in the profit-first world-view that are at the heart of ideas such as extended producer / provider responsibility and closed loop / cradle-to-cradle production (McDonough & Braungart, 2002; Senge, Seville, Lovins, & Lotspeich, 1999; Stahel, 1998).

These capabilities of the SSBMO helps it adhere to ontology Overall and Detailed Design Principles ODP1 & 2, and DDP1-3 and DDP6, and contributes to meeting RO1: if a business model designer is interested, it helps them ensure their business model design reliably, consistently, effectively and explicitly leverage the literature of organizational strong sustainability: specifically the importance of understanding both the positive and negative impacts of an organization's processes, in **all** the relevant contexts for **all** actors.

Sub-Perspective: Firm Process

Name	Generalization Sub-Perspective Firm Process
Definition	The concerns related to the processes that a specific ideal seeking multi-minded purposeful system requires to create and destroy value for its legitimized or impactful stakeholders now and in the future.
Related to (including cardinality of relationship)	Firm Process *is constrained by* Environment (1,1), and *occurs within the context of* Society (1,1) and Financial Economy (1,1) Process Perspective *provides additional context for* the Firm Process Sub-Perspective (1,n) Firm Process *provides the context for* the Partnership, Agreement, Decision, Capability, Resources, Value Configuration and Activity entities (1,n) (7) Firm Process *has* a large number of mandatory and optional many-to-many relationships with these entities (1,n or 0,n) Firm Process *provides* (Channel) Link (0,n) (Note optionality) Firm Process *exists* for each Firm in a business model (1,1)
Cardinality	1,n
Attributes	None specifically; implicitly any attribute related to the concept of organizations' processes required for the creation and destruction of value for the legitimized or impactful stakeholder actors thought to be relevant to the business model being described may be conceptualized, including location.
References	DDP1, 4.4.2 DDP2, **4.4.5**, 4.5.5, 4.6.5 DDP3, **4.4.3.4**, 4.4.4, 4.5.3.4, 4.5.4, 4.6.4.4, 4.6.4 DDP6, 4.6.5.5

Table 7-18: Sub-Perspective Generalization – Firm Process

7.3.3.7 Measurement

Name	Generalization Perspective Measurement
Definition	The concerns related to the definition and measurement of the success of a specific ideal seeking multi-minded purposeful system as agreed by its legitimized stakeholder actors. It is measured using an appropriate combination of environmental, social and monetary metrics with an applicable range of units.
Related to (including cardinality of relationship)	Measurement *is constrained by* Environment (1,1) Measurement *partially occurs within the context of* Society (0,1) and Financial Economy (0,1) Measurement *provides the context for* the Valuation Method, Tri-Profit, Account, Process Measure, Revenue, Cost and Asset entities (1,n) (7) Measurement *has* a large number of mandatory and optional many-to-many relationships with these entities (1,n or 0,n) Measurement *exists* for each Firm in a business model (1,1).
Cardinality	1,n
Attributes	None specifically; implicitly any attribute related to the concept of organizations' definition and measurement of success thought to be relevant to the business model being described may be conceptualized, including location.
References	DDP1, 4.4.2 DDP2, **4.4.5**, 4.5.5, 4.6.5 DDP5, 4.5.5.5, **4.5.5.7** DDP6, 4.6.5.2 (Table 4-15)

Table 7-19: Perspective Generalization – Measurement

This perspective allows a business model designer, if their world-view allows it, to describe the understanding of success and its measurement of an organization's legitimized stakeholder actors.

The definition of a strongly sustainable organization, if humanity is assumed to be operating at exactly the planetary limits, implies that while some firms can grow in various dimensions (environmental, social and economic) other firms must at the same time shrink in some manner, and perhaps ultimately cease to exist (this idea is explored in Upward, 2011). This lays to reset to the idea that all firms can grow simultaneously and infinitely within our semi-open and finite environmental context.

At first glance such a conclusion might be seen as very problematic. However, reflecting the author's experience, in practice the problem seems unlikely to be important. Firstly many entrepreneurs are not interested in having as a definition of success the growth of a globe-spanning multi-national corporation; rather they are interested in growing their organizations only as far as required to deliver value they believe important while supporting their personal short and long term needs[32]. Secondly, historically, the vast majority of firms fail to survive, let along grow, over long periods of time (Organization for Economic Co-operation and Development (OECD), 2001; Upward, 2011).

Unlike the BMO, the SSBMO encourages a business model designer, if their world-view allows it, to explicitly consider any definition of success measured in any applicable units held as important by the organization's legitimized and / or impactful stakeholder actors. Further it encourages the designer to consider a range of techniques and methods for the measurement of each success metric.

However, it behoves a business model design to carefully consider the metrics, their units and the threshold values that will define success, since, as Einstein is believed to have said "Not everything that can be counted counts, and not everything that counts can be counted". Further, confounding the typical profit-first assertion that 'what gets measured gets managed' creating and measuring emergent properties such as sustainability outcomes, is not the same as managing a mechanistic production line. "We wish to *attain* the flourishing that sustainability makes possible, not *manage* it" (Italics added to Ehrenfeld, 2008, p.106)[33].

[32] This is perhaps the idea that many people wish their firms to grow to the size that can be supported by the local economic-socio-bio-geo-physical environment; this is similar to properties of a climax biophysical ecosystem which climaxes within the constraints of a particular biome. Of course such ecosystems are far from static, with considerable innovation and growth constantly occurring (Schneider & Sagan, 2006, pp.275-298).
[33] Also see this useful background from a (at best) weakly sustainable perspective (Kleiner, 2002).

This capability of the SSBMO helps it adhere to ontology Overall and Detailed Design Principles ODP1 & 2, and DDP1 & 2, and DPP5 & 6, and contributes to meeting RO1: if a business model designer is interested, it helps them ensure their business model design consistently and explicitly considers a broad range of success measures and methods for their measurement in a variety of natural and social science units.

7.3.4 Generalization Summary

Figure 7-7 shows how in the detailed formal diagrammatic representation of the SSBMO (SM4), all the generalization entities and their inter-relationships are coded (5.4.4).

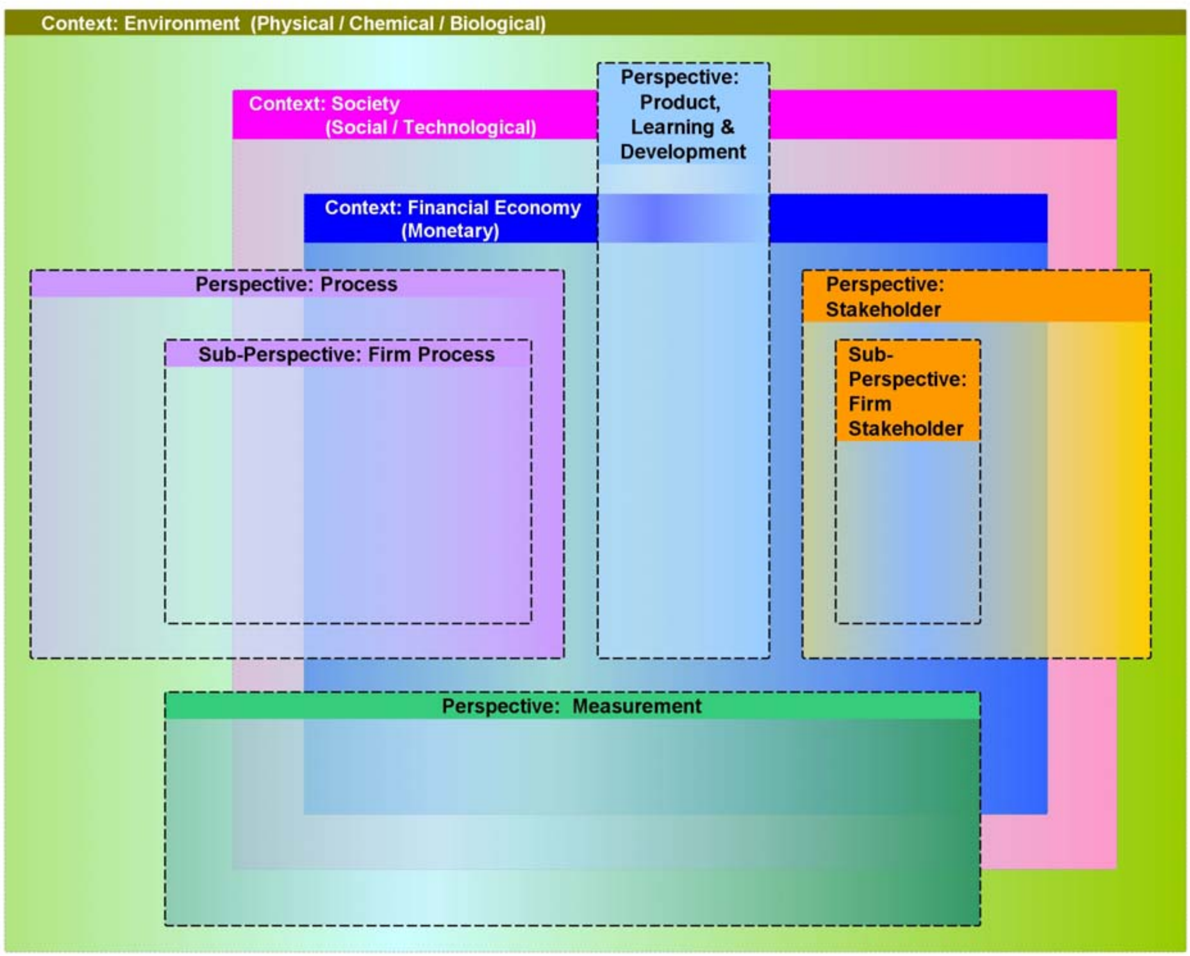

Figure 7-7: Generalization Summary – Detailed view of Context and Perspectives

The three Context Generalization entities are coded as coloured rectangles nested within one another, indicating their holonic inter-relationships. The six Perspective Generalization entities are coded as rectangles which each overlap all the Context Generalization entities. This indicates, for the entities within them, their mandatory relationship with the biophysical environment and, depending on their coding, their possible relationship with human society and the financial economy.

As described in 7.4.2, and as coded in the detailed formal diagrammatic representation (SM4), Firm has a one to many relationship with the Firm Stakeholder, Product Learning & Development, Firm Process and Measurement Perspective generalization entities, and hence with all the specific entities contained within these four perspective entities. This allows the SSBMO to simultaneously represent instances of entities shared by all firms (Actors, Needs, Bio-physical Stocks and Eco-system Services) and instances of entities that are related to each specific firm in a business model (the remaining 22 specific entities).

For easier comprehension by the business model designer, the summary diagrammatic representation (SM3) omits the two sub-perspectives. This is made possible by the summary visual representation allowing specific entities with "significant numbers of relationships", i.e. Firm, to be shown as enclosing the specific entities with which it has a relationship (5.4.5).

Building on the three dimensional view of the Context Generalization entities (Figure 7-4) Figure 7-8 shows how this can be visualized in three dimensions.

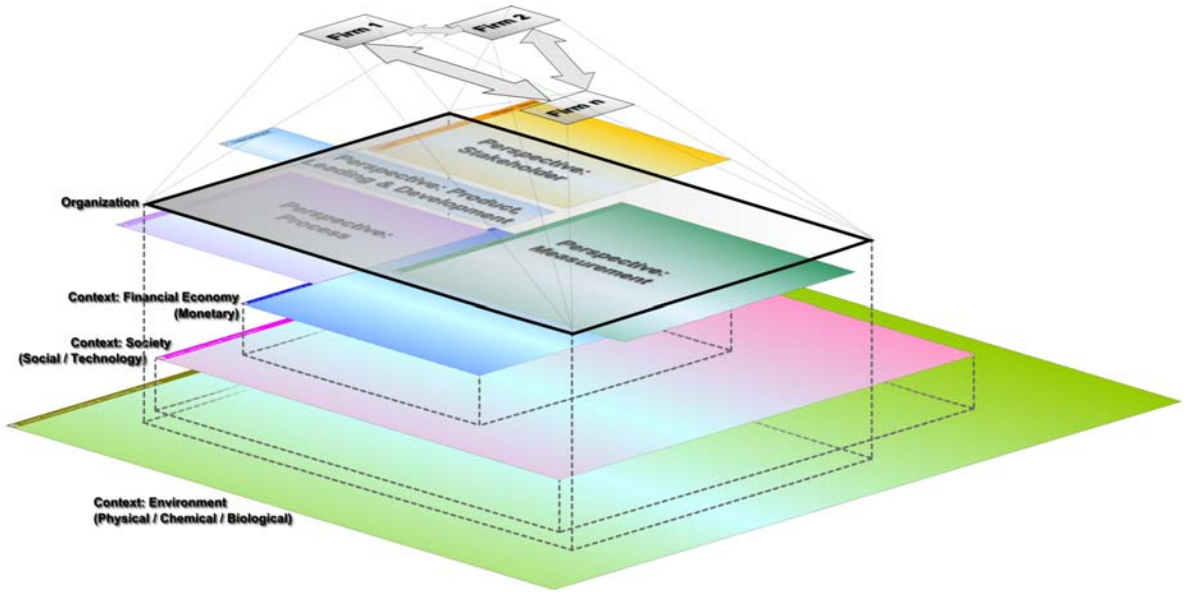

Figure 7-8: Firm Entity Relationship with Context and Perspective Generalizations – Three Dimensional View

In Figure 7-8 the boundary of all the organizations involved in a business model might be thought of as a box that is ‘above’ the biophysical environment, human social and financial contexts. Some elements of all the organizations in a specific business model relate only to the environmental, some elements relate to the social (and hence the environmental), and some relate to the financial (and hence the social and environmental).

Further the Perspective Generalization entities are shown just ‘below’ the organization box, indicating how each of these perspectives must be considered for each organization involved in a business model.

Finally, the Firm 1..n boxes are shown ‘floating’ above the organization (firm) box; via the lines, each of the three organizations in this specific business model will have an associated set of instances of **all** the specific entities enclosed within the organization entity box.

Figure 7-9 shows how, as per the summary diagrammatic formalism (5.4.5), Figure 7-8 inspired the ‘flattening’ of this three dimensional view to create a two dimensional view used in the summary representation of the SSBMO (SM3) and SSBMC (SM5).

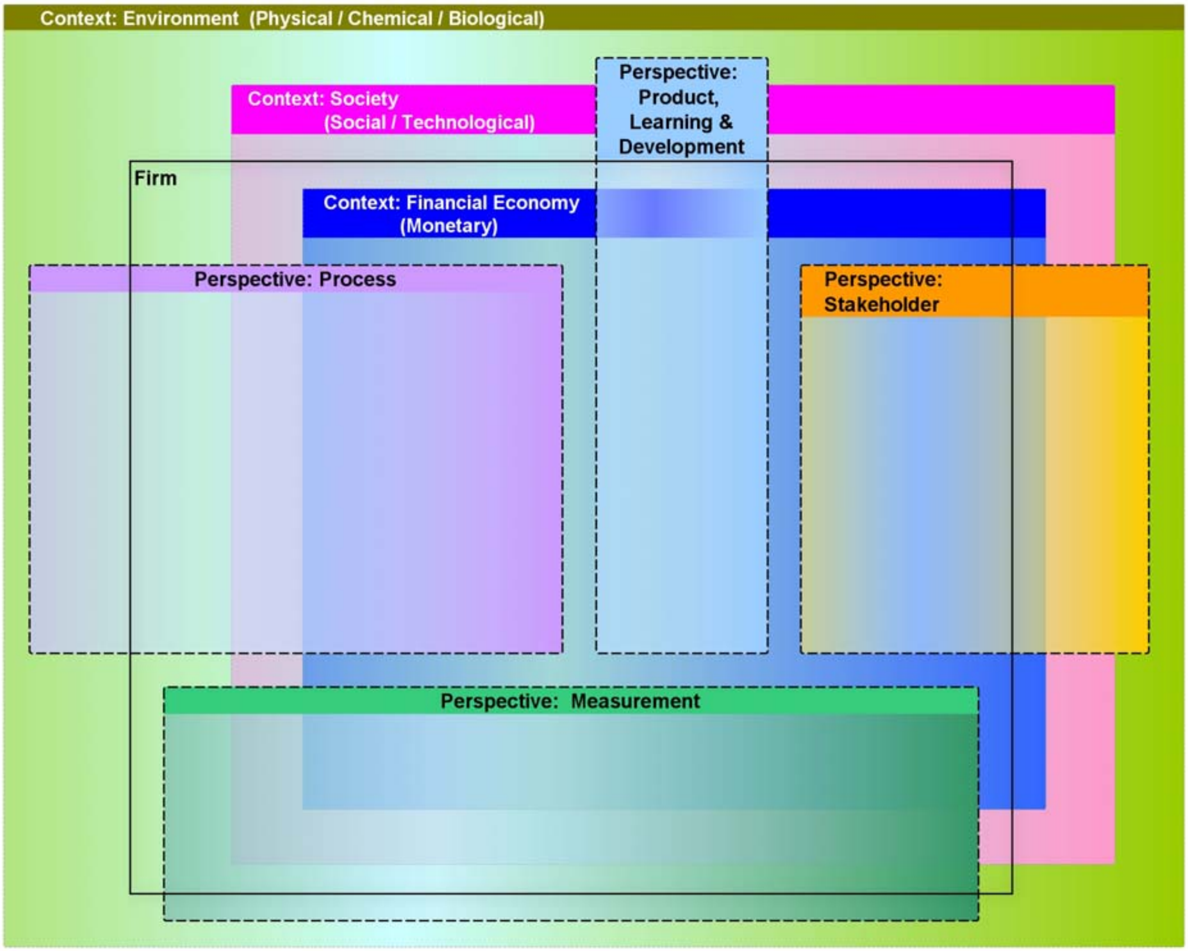

Figure 7-9: Generalization Summary – Summary View of Context and Perspectives Including Firm Entity Relationship with Generalizations

It is hoped this summary representation of the relationship between the Firm entity and the perspective generalizations is more comprehendible than the detailed sub-perspectives required by the detailed coding formalism (5.4.4). This was the visual representation used during the evaluation activity stream.

7.4 Specific Entity Descriptions

7.4.1 Introduction

This section describes (captures) each specific entity coded in the SSBMO detailed, formal, diagrammatic representation (SM4).

7.4.1.1 Relationship of Environment Context Generalization and Specific Entity Concepts

As expected for a model of a social construction (a firm and its business model) the majority of the specific entities model socially constructed concepts (7.1.1).

However unlike the BMO, whose elements are all socially constructed, the SSBMO includes a number of entities whose instances may model an entirely biophysical concept. This enables the SSBMO to model concepts outside the boundary of human society that may place important constraints on a firm's business model. Table 7-20 lists these entities and provides some examples.

Specific Entity	**Relationship to Society Context Generalization**	**Example of Non-Social Instance**
Actor	Instances may be social	Non-human animal, plant or non-living matter
Need	Instances may be social	Needs of the non-human (these may be highly similar to human needs, 4.4.3.4)
Bio-physical stock	Instances are never social	The individual instances of all matter in the biosphere (Table 4-6). (Although humans are a bio-physical stock, the Actor entity models the social aspects of human behaviour)
Activity	Instances may be social	Physical process ('heat', 'beat', 'irradiate'), chemical reaction ('treat') or biological process ('grow') (these are the ultimate mechanisms that can transform all resources)[34]
Eco-system Services	Instances are never social	The individual instances of all services and the flows they produces anywhere in the biosphere (Table 4-5)[35]
All Measurement Perspective specific entities (Valuation Method, Tri-Profit, Account, Process Metric, Revenue, Cost, Asset)	Instances may be social	The metric of any Measurement Perspective specific entity instance may be solely in biophysical units (e.g. J, Kg, mol, IU)

Table 7-20: Specific Entities with (Possible) Non-Social Instances

[34] Growth may require social relationships related to care and nurturing.
[35] Some eco-system services are social in nature, e.g. "appreciation".

7.4.1.2 Relationship of Summary and Detailed Entities

DDP5 identified 11 summary concepts and 9 related detail concepts (the 9 "building blocks" from the BMO, See Table 4-10).

The relationship between these summary and detailed concepts is not one of general conceptual generalization and specification; rather they are very explicit "set of" / "part of" relationships (as per Osterwalder, 2004a, Fig. 22 p.47).

Hence, as per the ERM formalism (5.2.3.1), these relationships are described explicitly between specific entities that model the related summary and detailed concepts.

However, this has the disadvantage of not explicitly highlighting to the business model designer the pairs of entities and their important explicit summary / detailed inter-relationship[36].

Given the importance to understanding the SSBMO of these summary / detailed relationships, finding a way to overcome this weakness could have significant implications for artefact utility (RQ).

Perspective Generalization Entity	**Related Pair** **Summary Specific Entity**	 **Related Detailed Specific Entity**	**BMO "Building Block"** (Osterwalder, 2004a, Table 16 p.43)[37]
Stakeholder	Actor	Need	✗
Firm Stakeholder	Target Stakeholder	Criterion	✓
Firm Stakeholder	Relationship	Function	✓
Firm Stakeholder	Channel	Link	✓
Product, Leading & Development	Value Proposition	Offering	✓
Firm Process	Partnership	Agreement	✓
Firm Process	Capability	Resource	✓
Firm Process	Value Configuration	Activity	✓

Table 7-21: Summary and Detailed Specific Entities

[36] This may be one of the reasons why Osterwalder did not attempt to explicitly use the ERM formalism. He coined the term "building block" to highlight the pairs of entities with summary / detailed relationships. He subsequently used the building blocks as the basis for simplifying the BMO into the BMC visual design tool.

[37] Two BMO "building blocks", consisting of the Revenue / Pricing and Cost Structure / Account summary / detailed components do not have a summary / detailed relationship in the SSBMO. See Table 7-6 for how these components

The approaches chosen in this presentation of the SSBMO to help the reader understand the nature and importance of the summary / detailed entity pairs and their relationships are as follows:

1. Listing the specific entities with a summary / detailed relationship in Table 7-21.
2. The textual formal description of each specific detailed entity in the SSBMO:
   – Captures the related summary entity name in brackets immediately prior to the detailed entity name (See BNF description of "Name" row of Table 7-7)
   – Can be better understood by pre-pending their related summary entity name, in an adjective noun relationship, e.g. one summary – detailed entity pair is Partnership and Agreement. Hence the Agreement detailed entity may best understood as modelling a Partnership Agreement, or alternatively the Agreements within a Partnership.

     This is possible because the summary-detailed entity pairs both have noun labels such that the summary entity name may also be used as an adjective that helps to describe the specific concept of the related detailed entity[38].
3. In the detailed diagrammatic formalism that codes the SSBMO, the summary entities are always shown above and spatially proximate to their related detailed entity (SM4). Where possible, the summary entity is coded immediately vertically above the related detailed entity.
   – This approach to spatially represent the summary – detailed entity relationships is also adopted in the detailed formal diagrammatic representation of the BMO (SM2), the summary diagrammatic representations of the SSBMO (SM3) and the BMO (SM1)[39].

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[38] This is a normal approach to describing summary / detailed entity relationships used in the ERM formalism. This approach was beautifully and consistently applied by Osterwalder in his choice of names for the pairs of "elements" in his 9 "building blocks"; albeit without description of the formalism norm being applied.

[39] Although not known to be an explicit part of the ERD formalism this approach does apply a cultural norm of an "above" / "below" spatial relationships mapping to a "summary" / "detailed" conceptual relationship. This

7.4.1.3 Presentation of Attributes

In the ERM formalism attributes are always related to a single entity, and may serve, in the case of identifier attributes, to uniquely identify each instance of that entity (5.2.6, 5.4.4).

To help comprehension of an ERM, the approach to choosing the noun labels of each attribute and their related entities is the same as that taken for entities with a detail - summary relationship. i.e. an attribute can be better understood and referred to by pre-pending its related entity name, in an adjective noun relationship, e.g. one attribute of the Relationship entity is Equity Level. Hence the Entity Level attribute may best understood as modelling the Relationship Equity Level, or alternatively the Equity Level of a Relationship.

For attributes of detailed entities, the name of the summary entity name may also be pre-pended. For example the Function, entity has an attribute Time Span and has the related summary entity Relationship. Hence the Time Span attribute may be best understood as modelling the Relationship Function Time Span, or alternatively the Time Span of a Relationship's Function.

7.4.1.4 Specific Entity Presentation Sequence

The sequence in which the Perspective generalization entities were presented was introduced in 7.3.3.2, corresponding to reading the summary and formal detailed diagrammatic representations (SM4) from the Top Right, in a Right to Left ***then*** Top to Bottom order.

The specific entities are presented below in groups, following this same order, based on their related Perspective generalization.

Within each Perspective generalization the same rule is followed to sequence the descriptions of the specific entities. The sequence of the descriptions of the specific entities starts in the Top right of each Perspective generalization and follows a Right to Left ***then*** Top to Bottom reading of formal detailed diagrammatic representation (SM4).

As noted in 7.3.3.1 the Firm entity is presented first since it is not contained by any Perspective generalization entity.

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approach was also adopted and consistently applied by Osterwalder, again without description of the norm being applied.

7.4.2 Firm Entity

Name	Firm (aka Organization)
Definition	A social construction to enable collaboration created by some agreement of multiple minds that its existence can better fulfill one or more of their diverse needs than would otherwise be the case. "Focal firm" = The firm whose business model[40] is being described by an instantiation of the SSBMO. <Another organization> =All organizations with which the focal firm has relations as part of its logic of existence (other firms, NGOs, governments, etc.) Relevant portions of each of these other organizations' business model forms a part of the focal firm's business model[41].
Related to (including cardinality of relationship)	Firm *is constrained by* Environment (1,1) Firm *occurs within the context of* Society (1,1) Firm *may occur within the context of* Financial Economy (0,1) (The optionality is provided to allow consideration of non-monetary organizations, rare those these may be) Firm *is an* Actor (1,1) Firm *has relations with* another Organization (0,n, 1,1). (The focal firms' business model includes portions of all the business model's of all organizations with which it has relations) Firm *has* a Firm Stakeholder, Product, Learning & Development, Firm Process and Measurement perspective (1,1) Firm *is created by* Target Stakeholder (2,n) (i.e. firms are socially constructed by at least two stakeholders who receive value from the firm) Firm *is created by* Target Stakeholder who *have* Relationship with the Firm. Relationship *may be formalized* by Partnership Firm *is an* Actor who can *take on a role as a* Target Stakeholder *of another* Firm
Cardinality	1,n

[40]i.e. "a description of the logic for its existence: who it does it for, to and with; what it does now and in the future; how, where and with what it does it do it; and how it defines and measures success." (DDP2)
[41] As per definition of a strongly sustainable organization, 3.5.3.4 A Definition of Organizational Strong Sustainability.

Name	Firm (aka Organization)
Attributes	Name (Identifier) = All characters Description = All characters Is Focal Firm = “Yes” | “No” Profit Distribution Model = A description of how a firm chooses to distribute their Tri-Profits (or losses) with all actors Legal Entity Type = “Certified”] “Benefit Corporation” | “Co-operative” | “Partnership” | “Not for Profit” | “Charity” | “Government” | “For Profit” | etc. [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> “,” <Longitude> “,” <Elevation> } >]
References	DDP3 DDP6 (Banathy, 2011; Blattberg, 2000; Gharajedaghi, 2011; Parhankangas, Ing, Hawk, Dane, & Kosits, 2005)

Table 7-22: Firm

The Firm entity encourages the business model designer to consider which organizations are involved in the focal firm’s business model, the business model being described:

- Which organizations are in your value network (supply chain) in order to create, deliver and maintain your value propositions?
- What are the business models of these organizations?
- How do those organizations’ creation, delivery and maintenance of their (positive and negative) value propositions impact your definition and measurement of success?
- What exists outside the social boundary of the firm, but upon which the success of the firm depends or impacts?

The choices about which instances of other entities have relationships with a particular firm together enables the SSBMO to model the multi-aspect boundary of a firm (see list of aspects in DDP3). Further the SSBMO conception of a firm recognizes that even the largest firm only has privileged access to a sub-set of the biophysical resources and flows of benefits from eco-system services.

The conception of a firm has a possible many-to-many relationship with a concept not included in the SSBMO: legal entity. The relationship between a Firm and its legal existence is not unimportant. However, at the level typically considered in a business model, it is a detail. Business model designers are urged to seek appropriate professional advice and, if their world-view allows, consider using new legal corporate forms such the Benefit Corporation (B Lab, 2009).

Several instances of Firm can be related to the same instance of another entity, e.g. since a Firm is an Actor, one of the roles a firm can play is as a Stakeholder to another Organization. Hence, two or more firms can make a Partnership consisting of a number of Agreements between them concerning a Resource and / or an Activity. Further, firms can collaborate on an Activity or share the use of a Resource. Firms may also have common Target Stakeholders. Together this enables all the relationships in an end-to-end / cradle-to-cradle business network business model to be described.

The Firm:

- Is Focal Firm attribute allows the business model designer to identify the firm whose business model is being described.
- Profit Distribution Model attribute gives the business model designer the opportunity to consider, as a matter of principle (recorded by a Firm's Measurement Perspective), how the benefits created and harm caused are to be distributed across all Actors.
- Legal Entity Type attribute gives the business model designer the opportunity to consider the current or best future legal entity type for the focal firm, or for actual or desired stakeholder organizations.
- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Firm in a business model

(as per DDP6). Location can be considered as part of the Social Context of a Firm (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of a Firm (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

Figure 7-10 shows a soft systems perspective on organization that is aligned with the SSBMO conception of a firm as multi-minded purposeful ideal seeking system. This is included to help the reader understand the broad systems oriented conception of the Firm within the SSBMO.

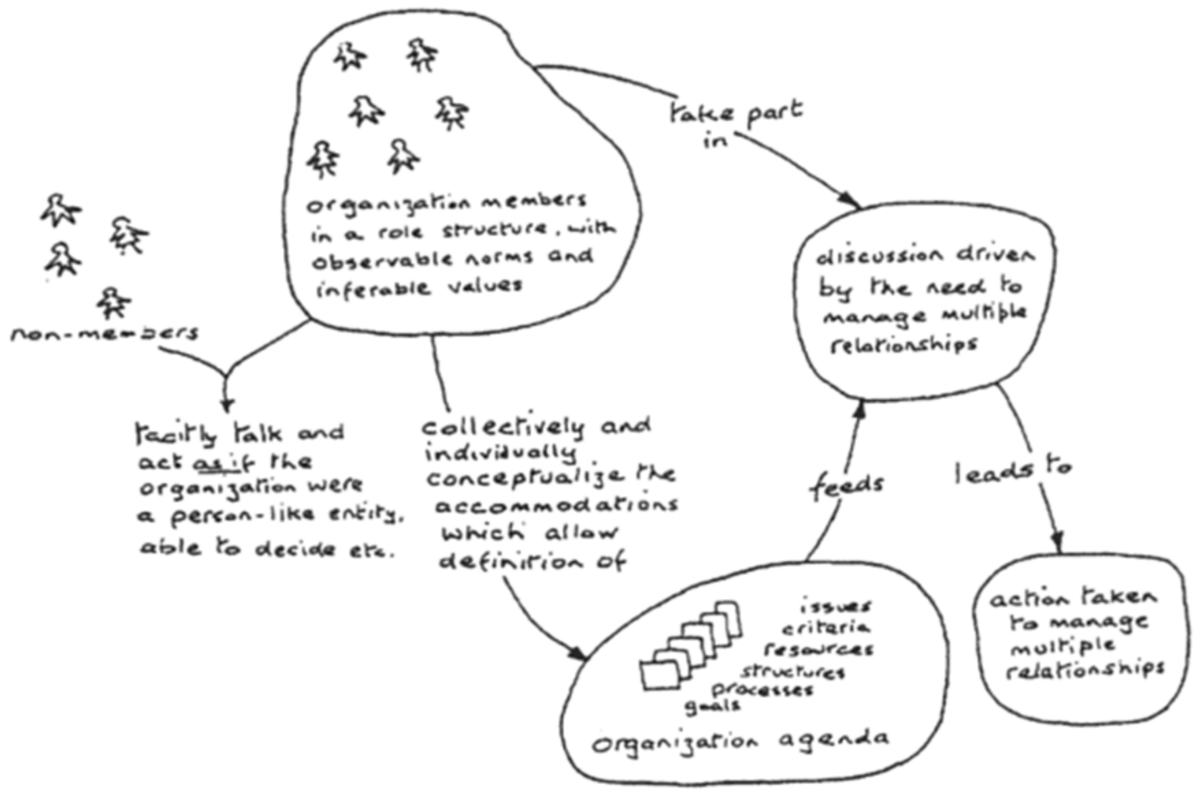

Figure 7-10: A Soft Systems Conception of a Firm
(Checkland, 1998, Fig.3.3 p.83)

7.4.3 Stakeholder Perspective Entities

7.4.3.1 Introduction and Overview

Based on the overall and detailed design principles the SSBMO includes the overall idea of stakeholder, replacing the more limited concept of customer in the BMO. Stakeholder replaces the idea that customers are the sole type of stakeholder that must be considered in an organization's business model (Freeman, 1984). Stakeholder theory:

> *Views the corporation as an organizational entity through which numerous and diverse participants accomplish multiple, and not always entirely congruent, purposes* (Donaldson & Preston, 1995, p.70)
>
> *Stakeholder management requires, as its key attribute, simultaneous attention to all appropriate stakeholders, both in the establishment of organizational structures and general policies and in case-by-case decision making* (p.67).

In addition to the works cited by Osterwalder (2004a, pp.60-77) the works cited in Chapters 3 and 4 from which the design principles were derived provide theoretical support for this (re) conception of the specific entities within the Stakeholder Perspective of a strongly sustainable business model. In addition the specific works by Klassen & Whybark and Sarkis et. al. provided direction and support (Klassen & Whybark, 1999; Sarkis, Zhu, & Lai, 2011).

Together instances of the specific entities within the Stakeholder Perspective describe "who a firm does it for, to and with". Entities within the Firm Stakeholder sub-Perspective are related to specific firms within a business model. Entities outside the Firm Stakeholder sub-Perspective are not related to any specific firm, and hence are shared by all actors, whether stakeholders of any firm in a business model or not.

7.4.3.2 Actor

Name	Actor
Definition	A human or non-human agent with Needs that has some potential or actual involvement in a firm's business model.
Related to **(including cardinality of relationship)**	Actor *is one part of* Environment (1,1) Actor *sometimes occurs within the context of* Society (0,1) and/or Financial Economy (0,1) Actor *occurs within the context of* Stakeholder Perspective (1,1). Actor *is a* Firm (0,1) (Note cardinality i.e. Actor may be a Firm) Actor *has a set of* Need (1,n) Actor *takes on a role as* Target Stakeholder (0,n) (i.e. Actors may take on none, one or more Target Stakeholder roles for one or more organizations; each role for each organization may be the same or different) Actor *is a* Bio-physical Stock (1,1) Actor *represents* another Actor (0,n; 1,1) (*Acts on behalf of* or *is represented by*; Note optionality) Actor *has a set of* Need each one of which may be satisfied by *taking on a role* as one or more Target Stakeholder in order to *receive* the Value Proposition of one or more Firm *delivered by* Channel as a result of *establishing* Relationship.
Cardinality	1,n
Attributes	Name (Identifier) = All characters Description = All characters [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]
References	(Osterwalder, 2004a, Table 30 p.80) DDP5 DDP6, 4.4.3.4

Table 7-23: Actor

The Actor entity encourages the business model designer to consider for the business model being described:

- Who are the human, groups of human (and perhaps non-human) actors who may choose to get involved in this business model?
- Which human actors are representing the needs of other humans and non-humans?

The BMO does include an actor entity, but it is conceptualized only as a way to include suppliers of resources and activities (Osterwalder, 2004a, p.80). In the SSBMO actor is directionally conceptualized, as per theories such as Latour's Actor Network Theory (ANT: Latour, 2005), as any living (human or non-human) or non-living entity that may 'play a part' or 'take a role in' in a business model. As a result of this conception an instance of Actor **must** also be an instance of Bio-physical Stock.

Business model designers should consider all possible, current and future, humans, non-human animals, other current life and any other biophysical elements on planet earth that might have some cause to become involved in the organization's business model (directly, or via another related organization – supplier, partner, regulator, customer etc.).

Actors representing other actors include:

- NGOs representing humans, non-human life or biophysical spaces
- Persons representing family's of humans
- Industry associations representing consortia of firms
- Governments representing and / or having power over groups of humans

A firm will create and/or destroy value for an actor implies that the actor has a relationship with and a role in the firm, whether or not:

- The firm desires such a relationship (intentionality on the part of a firm in creating or destroying value for an actor is unimportant).
- The actor is consciously aware of the connection between the value received and the organization(s) whose processes result in that value being created and destroyed.

Table 7-24 provides a partial list of possible actors developed with other participants of The Natural Step Boot Camp during a stakeholder analysis exercise on August 29, 2012.

Type of Actor	Possible Related Context Generalization	Example
Individual Human	Environment, Society	This author, etc.
Group of Humans	Society, Economic	Community, NGO, Government, Firm, etc.
Non Human	Environment, Economic	Non-human animal, biome, landscape, ecosystem, plant, naturally occurring or artificial geo-bio-physical artefact, etc.

Table 7-24: Possible Actor Instances

The Actor Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each actor in a business model (as per DDP6). Location can be considered as part of the Social Context of an Actor (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of an Actor (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a biome that defines the area in which a species can survive).

7.4.3.3 Need

Name	(Actor) Need
Definition	Something that is perceived by an Actor as necessary for them to survive and / or for its flourishing to be possible. Some of these could be satisfied through an Actor's Relationship with a Firm.
Related to (including cardinality of relationship)	Need *is constrained by* Environment (1,1) Need *sometimes occurs within the context of* Society (0,1) and/or Financial Economy (0,1) Need *occurs within the context of* Stakeholder Perspective (1,1). Need *defines one characteristic of* Criterion (0,n) (Note optionality) Need *is required by* Actor (0,n) Needs *are met or go unmet* through the satisfiers created by a Value Proposition Offering. Value *is created or destroyed* via one or more Channel Links. Target Stakeholder Criterion *match* a Need and a Relationship Function with the appropriate Channel Link so that a Value Proposition Offering may be delivered to a Stakeholder Actor.
Cardinality	1,n
Attributes	Name (Identifier) = All characters Description = All characters [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]
References	DDP6, 4.4.3.4

Table 7-25: (Actor) Need

The Need entity encourages the business model designer to consider what needs the actors have that their business model:

- Might be able to satisfy?
- Might prevent an actor from fulfilling?

The BMO does not conceptualize needs (or wants). The SSBMO encourages business model designers to consider the needs of all the actors identified – think Maslow's "Hierarchy of Needs" or Max-Neef's "Fundamental Human Needs" (4.4.3.4). It is important for a business model designer to think about needs broadly, considering the needs the organization being designed will proactively meet, **and** the needs that an actor may have a harder time satisfying as a consequence of the organization's business model (e.g. the business model of a mining company that may prevent first nations from meeting their need for subsistence from hunting by destroying their trap lines).

Needs can be expressed as a positive or negative: "I need clean air" (positive), or "I need an absence of pollution" (negative).

Business model designers should consider carefully the type of satisfier (4.4.3.4) that a value proposition creates, i.e. a want vs. a need. Maslow and Ehrenfeld both identify a powerful connection between satisfying the needs of actors and their subsequent flourishing (over time). This is seen to be in potential contrast with fulfilling wants, which may only lead to mere survival or perhaps languishing over time (Ehrenfeld, 2008; Max-Neef et al., 1991; Max-Neef, 2010).

The Need Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for Actor Need in the business model (as per DDP6). Location can be considered as part of the Social Context of a Need (i.e. relative to the location of the Actor, i.e. a Need only occurs at specific locations or within specific area where the Actor may be) or a constraint imposed by the Environmental Context of an Actor (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such a portion of a biome in which a species can survive).

7.4.3.4 Target Stakeholder

Name	Target Stakeholder
Definition	A role that an Actor takes due to their relationship with a Firm because 1. A Firm considers an Actor to be legitimate (i.e. actors that a firm believes are or should be its stakeholders) 2. An Actor chooses to impact a Firm (positively or negatively) (i.e. any actors who have, through their actions, claimed a relationship with the firm) 3. Of impacts (positive or negative) on an Actor due to the existence of a Firm and/or its operations (i.e. any actors for whom the firm is destroying value but who may not be aware of a causal relationship or having become aware have chosen not to act to claim a relationship) "Legitimized" | "Impacting" | "Impacted" = The nature of the role of the actor. Target Stakeholder Criterion attributes define the nature of their involvement with a specific Firm.
Related to **(including cardinality of relationship)**	Target Stakeholder *is constrained by* Environment (1,1), and *occurs within the context of* Society (1,1) and Financial Economy (1,1) Target Stakeholder *occurs within the context of* Firm Stakeholder Perspective (1,1) Target Stakeholder *is a role of* Actor (1,1) Target Stakeholder *of* Firm (1,n) (i.e. Target Stakeholder role may be shared by multiple organizations) Target Stakeholder *are defined by* Criterion (0,n) (Note optionality) Target Stakeholder *participate in* Activity (0,n) (Note optionality. This may or may not be the result of the Stakeholder *entering a formal* Relationship Partnership Agreement with a Firm) Target Stakeholder *allowed to take part in* Decision (0,n) (Note optionality, not all stakeholders are allowed to take part in decisions based on their relative informal and formal power) Target Stakeholder *uses* Channel (1,n) Target Stakeholder *receives* Value Proposition (1,n) (Value Propositions may be received as a result of a Target Stakeholder Relationship with a Firm) Target Stakeholder *has* Relationship (1,n) (By the definition of a firm as a social construct each Target Stakeholder must have at least one Relationship with a Firm) Target Stakeholder *has* Relationship *which can be formalized by entering into* Partnership Agreement (Target Stakeholder and Firm *can make* Partnership Agreement) Target Stakeholder *based on an* Agreement *may provide* Resources or *participate in* Activity

Name	Target Stakeholder
Cardinality	2,n[42]
Attributes	Name (Identifier) = All characters Description = All characters Type = “Legitimized” | <Impactful “Impacting” | “Impacted”> Relative Power = 0..100 Relative Diversity = 0..100 [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> “,” <Longitude> “,” <Elevation> } >]
References	(Osterwalder, 2004a, Table 23 pp.60-61) DDP5, 4.5.5.7 DDP6, 4.6.5.4 (Banathy, 2011; Bonnafous-Boucher & Porcher, 2010; Collins & Kearins, 2007; From Special issue on Stakeholder Theory in Journal of Business Ethics Freeman, Rusconi, Signori, & Strudler, 2012; Friedman, 2006; Gibson, 2012; Parhankangas et al., 2005; Rahman, Waddock, Andriof, & Husted, 2003, pp.9-12; Turcotte, 1995; Turcotte & Pasquero, 2001)(Freeman et al., 2012)

Table 7-26: Target Stakeholder

The Target Stakeholder entity encourages the business model designer to consider which actors have a role as a stakeholder of an organization within the focal firm’s business model:

- Who are your target stakeholders?
- Which actors are you choosing, and which actors are, may and will choose to become involved with and / or in your organization?

The BMO places great emphasis on actors who are customer stakeholders: the actors who as a result of their relationships with a firm pay money that creates monetary revenue for a firm.

[42] As a social construct a firm must have at least two target stakeholders.

Little emphasis is placed on other stakeholder roles. On the other hand, the SSBMO encourages a business model designer, if their world-view allows it, to explicitly consider all the salient roles of all possible actors now and over time. The Target Stakeholder entity is intended to provide the richness and flexibility to model all the roles that legitimate and impactful actors may wish or are compelled to take on.

The word 'target' is meant in both its 'positive' and 'negative' senses: being 'targeted by' and being 'the target of'. When a firm 'targets' a customer stakeholder, this is generally because the firm believes that this actor has needs that can be best satisfied if that actor becomes a stakeholder of type customer. However, when an actor finds themselves unwittingly impacted by a firm the language often used is that the actors was the 'target of' of the firm, irrespective of the firm's public and / or private intentions.

Actors whom a firm chooses to legitimate through formal decision at a point in time are known as legitimized (or recognized) target stakeholders. Target Stakeholder legitimation is a key type of Decision (governance arrangement). Legitimized stakeholders are usually formally given some rights or roles in firm governance (decision making). See the Decision entity for full discussion (7.4.5.2).

Actors who are impacted by or who choose to impact a firm are known as impactful Target Stakeholders. In this case firms' actions (intentional or not) may cause the actor to take on a role as a target stakeholder within the focal firm's business model.

Hence, impactful stakeholders may end up taking or asserting their rights to be involved in a firm's governance processes despite the fact that they have not been previously legitimated by the legitimate stakeholders who formally have the rights to make such a determination. Such assertion of rights often comes about as a result of conflict, initiated (often unexpectedly from a firm's perspective) by the previously impacted stakeholder (Conroy, 2007; Upward, 2010a).

Together this conceptualization allows the SSBMO to represent the concepts of legitimacy, urgency and power from stakeholder theory (Freeman, 1984; Sarkis et al., 2011, p.9).

Business model designers should consider carefully the risks, resilience and sustainability of their business model when they:

- Choose their legitimate stakeholders
- Decide how legitimate stakeholders are allowed to exercise power over the firm.

Specifically business model designers should carefully consider the:

- Impact of the relative formal and informal power of their legitimized stakeholders
- Impact over time of excluding one or more actors from being a legitimate stakeholder (could those actors choose to become powerful impactful stakeholders?)

An actor may be an individual human, an organization, or another firm. Hence a firm's target stakeholder may include the firm itself or other organizations (a firm may be considered by some business model designers as existing, at least in part, for its own sake).

Each actor may have many roles with each firm and with many firms in a business model at a point in time or over-time. i.e. an actor my be simultaneously a customer of one firm, a worker in a supplier firm, and a member of a community where one or more firms operate, etc. (e.g. someone who lives in the Global South working for the supplier of a Global North "leading brand" footwear firm may purchase those shoes for their children).

Each target stakeholder may have the same stakeholder relationship to one or more firms, e.g. a specific supplier, customer, employee, board member, regulator, community of one, two or more firms.

Target stakeholders use Channels defined by the firm to receive one or more positive or negative Value Propositions through the Relationships the Firm and Target Stakeholder have with each other.

Some relationships a Target Stakeholder has with a Firm will result in target stakeholders participating in one or more of a firm's activities without any formalization of the relationship. Examples may include stakeholder's

- Learning about and choosing to purchase a product or service
- Interactions with official or unofficial communities (e.g. 'letters to the editor', post-use marketplaces, on-line forums either to ask for or provide information).

Some Relationships may include formalized Partnerships consisting of Agreements. These agreements concern a stakeholder providing Resources to, receiving Resources from and / or executing Activities on behalf of a firm.

Table 7-27 provides a partial list of potential target stakeholder roles was developed with other participants of The Natural Step Boot Camp during a stakeholder analysis exercise on August 29, 2012. A search for an existing taxonomy for organizational stakeholders was undertaken without result; this unordered list is presented to aid comprehension of the breadth of the SSBMO conceptualization of stakeholder.

Employee (prospective, existing, former)	Worker (of another company)
Retiree	Manager
Community of Interest	Union
Officer (of a company)	Board of Directors (individual members, collectively)
Parent	Child
Family	Geographically defined Community (local, regional, national, continental, global)
Worker / employee / works committee	Grieving committee
Collective bargaining committee	Customer advisory boards
Board of patrons	Government (local, regional, national, international)
Shareholder (individually or collectively, e.g. at a shareholder meeting)	Owner
Rating agency	Investor
Financier	Customer
Supplier (products, services)	Competitor
Partner (individual or organization)	Collaborator (individual or organization)
Association (for organizations and individuals)	NGO (activist, collaborative, think-tank, advocacy/lobby)
Auditor (internal or 3rd party)	Watchdog
Regulator	Standards Body
Judicial Institution	Media (4th estate)
Consultant	Educational Institution
Generation (past, present, future)	Protestor (individuals, activist NGOs)
User (product, service, social media)	Constituency (political, or issue based)
Member (individually or collectively)	Department (internal functions within an organization)

Table 7-27: Possible Target Stakeholder Instances

The Target Stakeholder:

- Relative Power attribute gives a business model designer the opportunity to consider the impact of the different power levels of legitimated stakeholders on the value they receive.

  All actors (i.e. potential stakeholders) due to enviro-socio-economic factors outside of the control of the currently legitimated stakeholders, have differing levels of formal and informal power. These can systemically impact the outcome of satisficing decisions made, when no way to dissolve competing actor needs / purposes / interests can be found.

  The Relative Power attributes allows a business model designer to model these differing power levels by an arbitrary integer value assigned to each Target Stakeholder in comparison to all other legitimized stakeholders.

- Relative Diversity attribute gives a business model designer the opportunity to consider, in relation to all other stakeholders, how different this stakeholder is. Difference can be on any dimension considered important. For example diversity of ownership (i.e. ethnic minority, positive discrimination: women, veterans, etc.). A higher average score of this attributes for all the firms in a business model indicates a higher level of stakeholder diversity.

- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Target Stakeholder in the business model (as per DDP6). Location can be considered as part of the Social Context of a Target Stakeholder (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of a Target Stakeholder (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

7.4.3.5 Criterion

Name	(Target Stakeholder) Criterion
Definition	Relevant definitional attributes of a Firm's Target Stakeholder. These attributes enable the match of a Target Stakeholder's Need to a Relationship Function and Channel Link to enable Value Proposition Offerings to create or destroy value for the Target Stakeholder.
Related to (including cardinality of relationship)	Criterion *is constrained by* Environment (1,1), and *occurs within the context of* Society (1,1) and Financial Economy (1,1) Criterion *occurs within the context of* Firm Stakeholder Perspective (1,1) (i.e. Target Stakeholder Criterion relates to a specific Firm) Criterion *matches* (Actor) Need (1,n) Criterion *selects relevant* (Channel) Link (1,1). Criterion *matches* (Relationship) Function (1,n) Criterion *is an aspect of* Target Stakeholder (1,1) Criterion *selects relevant* Channel Links *that deliver* Value Proposition Offering *to* Target Stakeholder *that match* Actor Need
Cardinality	0,n
Attributes	Name (Identifier) = All characters Description = All characters [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]
References	(Osterwalder, 2004a, Table 23 pp.61) DDP5

Table 7-28: (Target Stakeholder) Criterion

Typically a firm does not desire to actively engage with all instances of a target stakeholder at a point in time or over time. It is important for the business model designer to consider what characteristics of each target stakeholder define the possibility for active engagement.

Target Stakeholder Criterion are used to specify relevant specific attributes of target stakeholders that:

- Match the needs of the associated Actor to the Function of the Relationship which the Target Stakeholder and Firm are entering into, maintaining or ending.
- Select the Channel Link(s) required to enable Value Propositioning Offerings to be delivered.

For example, a target (customer) stakeholder may be parents who have a need to clothe their children. This is a large target stakeholder group. But the human actors who may become customer stakeholders, parents in this case, also have a need to be able to walk to a store that sells suitable clothing, a level of monetary affordability, a level of concern for the situation in which the clothes are made, and a need for a pleasant social interaction in a store which employs their neighbours under equitable working conditions and wages. The function of this social relationship is to successfully acquire clothes that meet these needs. Together these needs serve to identify the nature of the Relationship Function the customer desires, the nature of the Channel Link (i.e. the retail Channel must have geographical proximity to the customers, i.e. walking distance). Together these criteria must be met if the firm's value proposition offerings (related to affordable, socially and environmentally responsible children's clothing) are to create positive value for some specific parents. In this way the attributes of a target stakeholder described by the criterion serve to help a business model designer 'segment' a large group of target stakeholders. It enables the business model designer consider in detail how the stakeholder actors' needs, and the functions of the relationships a target stakeholder has with a firm, interact with the proposed value proposition offerings. Similar examples can be conceived for other types of stakeholders: employees, suppliers, shareholders etc.

Criteria that match Needs and Relationship Functions and select Channel Links through which Value Proposition Offerings are delivered can be 'positive' or 'negative'. Positive criteria are usually mutually agreeable between the target stakeholder actor and firm based on the value which will be created for the target stakeholder actor (e.g. classic retail customer segmentation criteria to enable customer benefits based on socio-economic status, location, etc.).

In contrast negative criteria are usually forced by conditions created by one of the firm, target stakeholder or some state of the economic, social or biophysical system context (e.g. criteria an NGO may use to select a firm for a negative marketing campaign due to some aspects of the firm's value propositions which the NGO perceives as destroying value for the NGO's stakeholders) (Conroy, 2007).

The Criterion Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Target Stakeholder Criterion in a business model (as per DDP6). Location can be considered as part of the Social Context of a Criterion (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of a Criterion (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

7.4.3.6 Relationship

Name	Relationship
Definition	An association a Firm and / or Target Stakeholder desires to have, is maintaining or wishes to end. Over time the equity in the relationship changes between a Firm and a Target Stakeholder. Equity can be monetary, social and / or environmental, tangible or intangible. The greater the relationship equity the more resilient the relationship to change unanticipated by either party.
Related to **(including cardinality of relationship)**	Relationship *is constrained by* Environment (1,1), and *occurs within the context of* Society (1,1) and Financial Economy (1,1) Relationship *occurs within the context of* Firm Stakeholder Perspective (1,1) (i.e. relates to a specific Firm) Relationship *is maintained with* Target Stakeholder (1,n) Relationship *has* Function (1,n) Relationship *enables* Value Proposition (1,n) (In some cases it may be more useful to think of Relationship *promotes* Value Proposition)[43] Relationship *formalized by* Partnership (1,n)
Cardinality	1,n
Attributes	Name (Identifier) = All characters Description = All characters Equity = <Description of the combination of environmental, social and economic equity mutually desired to be grown in the relationship>[44] Equity Level = -100..+100 (An assessment of the current or desired level of equity; Negative numbers indicate that one or both parties wishes the relationship to end but is unable or unwilling to do so[45]; Positive numbers indicate that both parties wish the relationship to continue) [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> “,” <Longitude> “,” <Elevation> } >]

[43] Promotes is the verb used in the BMO. In the BMO ultimately a relationship only exists to cause a customer to buy (repeatedly).

[44] “Acquisition” | “Retention” | “Add-on Selling” are the possible values of the Relationship Customer Equity attribute in the BMO (Explained at some length in Osterwalder, 2004a, pp.72-73). The label “equity” is used for this attribute in the SSBMO, to generalize the concept to apply to any type of stakeholder. Further the

Name	Relationship
References	(Osterwalder, 2004a, Table 27 pp.71-73) DDP5

Table 7-29: Relationship

The Relationship entity encourages the business model designer to consider what relationships a firm requires with its stakeholders over time and the goals of those relationships in terms of the desired changes to the equity in the relationship:

- What relationships will be required with your stakeholders?
- What is the purpose of each relationship?

The Relationship:

- Equity attribute gives the business model designer the opportunity to consider, for each desired relationship, what the mutually agreeable combination of the six capitals will define the equity for the parties (natural, human, intellectual, social, manufactured, financial).
- Equity Level attribute gives the business model designer the opportunity to consider, for each Relationship Equity, how much of that Equity is ultimately desired. This allows the design of value propositions that satisfice, as opposed to satisfy.
- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Relationship in a business model (as per DDP6). Location can be considered as part of the Social Context of a Relationship (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of a

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concept of time embedded in the possible values of the BMO Relationship Customer Equity attribute is removed (see Relationship Function Time-Span attribute, 7.4.3.7)

[45] Perhaps unlikely to be a goal of a relationship in a improved business model, but may be a reality in the description of a relationship in an existing business model.

Relationship (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

The BMO considers only relationships related to customer target stakeholders and the ultimate generation of monetary profit. Hence the goal of a relationship is conceived of only from the perspective of a firm's financial goals, i.e. the only conceivable goal of a relationship between a firm and a customer stakeholder is to increase the firm's equity (specifically quantified on a balance sheet as goodwill and on a profit and loss statement as increasing revenues). Hence relationship goals are conceived as increasing customer equity by acquiring new, retaining current or repeat selling to existing customers. Not only are these primarily monetizable aspects of a relationship over time, they are arbitrary. Further, in the BMO it is not possible to conceive of a value proposition to cause a customer relationship with the firm to end: this is an omission, even within the profit-first world view, since a not uncommon requirement is to end relationships with 'unprofitable' customers.

On the other hand, the SSBMO broadly conceives of authentic trusting and respectful relationships as being the fundamental enabler for all a firm's value propositions and that a relationship is an indivisible whole. Trust and respect are seen as antecedents of growth and maintenance of social equity and hence the other six capitals. Thus Relationship Equity can be any mutually agreeable and personally meaningful combination of the six capitals enabled by trust. The SSBMO takes the position that the greater the Relationship Equity the more resilient the relationship.

However, even in the BMO's limited conception of relationships, the idea that a firm may need different value propositions and hence relationships and channels over time is well established. For example it is frequently the case that different value propositions, relationships and channels are required to find new customers vs. conducting (more or different) transactions with existing customers.

However, confusingly, the BMO concept of relationship equity conflates two ideas:

1. The nature of the equity to be maintained or grown in a relationship, and
2. The period of time during which the functioning of a relationship may need to vary to achieve the desired equity level.

To reduce the potential for confusion the SSBMO separates these two ideas. The nature of the desired equity in a relationship is captured in the Relationship Equity attribute. The period of time during which the functioning of a relationship may need to vary to achieve the desired equity level is captured in the Relationship Function Time-Span attribute (7.4.3.7).

7.4.3.7 Function

Name	(Relationship) Function
Definition	Relevant purposeful attributes of a desired Firm Relationship with a Target Stakeholder through time. These attributes define, at a given point in time, the desired purpose of a relationship between a Firm and a Target Stakeholder.
Related to (including cardinality of relationship)	Function *is constrained by* Environment (1,1), and *occurs within the context of* Society (1,1) and Financial Economy (1,1) Function *occurs within the context of* Firm Stakeholder Perspective (1,1) (i.e. relates to a specific Firm) Function *helps fulfill* (Target Stakeholder) Criterion (1,n) Function *achieved by* (Channel) Link (0,n) (Note optionality) Function *component of* (Value Proposition) Offering (0,n) (Note optionality) Function *of* Relationship (1,1) Relationship Function *helps fulfill* Target Stakeholder Criterion *by matching an* Actor Need *to a relevant* Channel Link *that delivers* Value Proposition Offering *to* Target Stakeholder.
Cardinality	1,n
Attributes	Name (Identifier) = All characters Description = All characters Time Span = { "Start Relationship" | "Maintain Relationship" | "Deepen Relationship" | "End Relationship" } Type = { "Build" | "Learn" | "Experience" | "Transact" | "Involve" | "Change" | "Continue" }[46] [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area:{<Latitude>","<Longitude>","<Elevation> >]
References	(Osterwalder, 2004a, Table 28 pp.73-77) DDP5 (Pink, 2012)

Table 7-30: (Relationship) Function

[46] "Personalization" | "Trust" | "Brand" are the possible values of the Relationship Mechanism Function attribute of the BMO (Explained at some length in Osterwalder, 2004a, pp.73-75). The label "type" is used for this attribute in the SSBMO, i.e. the nature of a Relationship Function helps describe how it contributes to Relationship Equity maintenance and/or growth.

Typically different Target Stakeholder Criterion drive a Firm's desire to grow Relationship Equity between the two parties over time. Different actions are required to grow that relationship equity at different points in time during which the relationship exists. It is important for the business model designer to consider the different needs and hence the different actions that may be required at different points in a relationship.

The Relationship Function entity describes how the actions designed to grow relationship equity over time relate to Target Stakeholders Needs. Actions that may need to differ over time are the Channel Links and/or the Value Proposition Offerings which will best increase relationship equity.

The Relationship Function

- Time Span attribute gives the business model designer the opportunity to consider the points in time that a Relationship Function applies.

  Unlike the BMO, in addition to wishing to start, maintain or deepen a relationship (Explained at some length in Osterwalder, 2004a, pp.51-52), the SSBMO conceives that there are circumstances where it may be of value to a firm and a stakeholder to end their relationship, but that this can be done in ways that protect or grow mutual equity.

  Further the SSBMO assumes that a Relationship Function may support extended Time-Spans, e.g. Start ***and*** Maintain, or Maintain ***and*** Deepen.

- Type attribute gives the business model designer the opportunity to consider the nature of the purpose of each Relationship Function.

  Unlike the BMO, the SSBMO conceives a broad range of purposes for a relationship, not simply those closely associated with generating monetary revenue.

  Further the SSBMO assumes that multiple Relationship Function Types may be applicable during the Relationship Function's Time Span(s), i.e. Type is ***not*** related to the Time-Span, but independent of it (i.e. the stage of a relationship over time), i.e. it may be appropriate for a Relationship Function Type to be any combination of Build, Learn, Experience, Transact, Involve, Change or Continue during any combination of Relationship Function Time-Span: Start, Maintain, Deepen, or End.

- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Relationship Function in a business model (as per DDP6). Location can be considered as part of the Social Context of a Relationship Function (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of a Relationship Function (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

Osterwalder does not explicitly discuss the detailed mechanics related to each relationship function time span in the BMO. However, it seems apparent that the mechanics are complex involving multiple cognitive steps. For example, before being willing and able to act to enter into or change their relationship with a firm often a stakeholder will first need to become aware of and then gain an appreciation and understanding of how a value proposition meets one or more of their criterion. In other words a stakeholder first must be convinced or convince themselves before they will act to start and then increase the equity in their relationship with a firm.

In a non-commercial setting generating convinced stakeholders may be referred to as education (for example delivered via a formal or self-study learning channel). In a commercial setting generating convinced stakeholders may be referred to as marketing and / or sales (for example delivered via web advertising and sales person channels). The large body of knowledge of how to effectively convince another party is considered part of the discipline of psycho-sociology, and in the context of organizations is the field of marketing and sales.

There are numerous examples where the knowledge of marketing and sales has been used without concern for the nature of the value proposition and its immediate and ultimate impacts on legitimated and impactful stakeholders. Despite serious ethical and moral concerns, in the name of maximizing short term monetary profit, many current marketing and selling efforts are directed at convincing customer stakeholders that value propositions, known to include violator, destroyer, pseudo, and / or inhibiting satisfiers for one or more actors, are in fact singular or synergistic satisfiers.

However this unethical use does not mean that the all or most of the knowledge of how to convince another party is in of itself unethical (Pink, 2012). The same knowledge can be used to convince people to stop or start an individual or socially beneficial behaviour. For example public service marketing and sales campaigns have successfully encouraged a range of stakeholders to help smokers stop smoking and automobile users to wear seatbelts.

Business model designers should carefully consider how the psycho-social tacit and explicit knowledge of sales and marketing may grow or shrink desired relationship equity over short and long time frames.

While the research cited by Osterwalder (2004a, pp.73-77) discusses marketing and sales knowledge which can impact relationships, it is unclear whether the list of Relationship Mechanism Functions provided is intended to be suggestive or complete.

Systems thinking theories such as requisite variety, in the context of designing value propositions (i.e. satisfiers) for social animals such as humans suggests that

- Relationships are required for many if not all satisfiers
- There are at least as many functions of a relationship as there are related fundamental human needs.

With this in mind Table 7-31 synthesized from the literature (Chapter 3 and 4), suggests a list of possible Relationship Function Types which it is recommended the business model designer consider.

Relationship Function Type Value	Examples
Build	Trust, Identity[47]
Learn	Educate, Inform, Experiment
Experience	Benefits of or Harm Caused by Use, Risk Reduction, Effort Reduction Shared / Collective, Personal / Individual[48] Emotion
Transact	Awareness; Evaluation; Acquire, Purchase or Sell; Post-Transaction
Involve	(Co-)creation, Purchase or Sell, Give or Donate, Use, Renewal, Transfer
Change	Conflict, Compromise, Negotiate, Dissolve / Talk it Out, Presence[49]
Continue	Collaborate / Synergistic, Compete / Parasitic

Table 7-31: Possible Relationship Function Type Attribute Values

From Table 7-31 it becomes clear that irrespective of the Relationship Function Time Span and the Type, the ability of a channel link to increase relationship equity will be related to how psycho-social knowledge, including knowledge of marketing and sales, is deployed by and during those links.

[47] The BMO makes the connection (with citations) between a firm's brand and the similarity of the concepts of organizational brand and individual identity.

[48] The BMO makes the observation that information and communications technologies are making it possible for firms to economically leave the impression of personalized service, even when no human is directly involved in the firm at the point in time an interaction between firm and stakeholder occurs. Prior to this technology, leaving the impression of personalized services was thought to be too expensive given the cost of the persons required to be employed and their inability to keep track of details of large numbers of relationships that large organizations desire to maintain with their stakeholders.

[49] To ensure a firm is able to deliver value propositions related to its future existence (DDP4), relationship functions which sets-up 'adaptive tensions' between existing and potential future stakeholders and their respective current and future needs should be considered.

7.4.3.8 Channel

Name	Channel
Definition	A mechanism that delivers a Value Proposition to a Target Stakeholder. Channels allow Firms to Start, Maintain, Deepen and End a desired Relationship through the delivery of a Value Proposition.
Related to **(including cardinality of relationship)**	Channel *is constrained by* Environment (1,1), and *occurs within the context of* Society (1,1) and Financial Economy (1,1) Channel *occurs within the context of* Firm Stakeholder Perspective (1,1) (i.e. a Channel is unique to a Firm) Channel *delivers to* Target Stakeholder (1,n) Channel *consist of* Link (0,n) (*has*, note optionality) Channel *delivers* Value Proposition (1,n) Channels *consist of* Links, created by: Firm Process of the Firm that defines the Value Proposition, or any other Organization with whom the Firm has a Relationship (potentially formalized in a Partnership)
Cardinality	1,n
Attributes	Name (Identifier) = All characters Description = All characters [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> “,” <Longitude> “,” <Elevation> } >]
References	(Osterwalder, 2004a, Table 25 pp.63) DDP5

Table 7-32: Channel

The Channel entity encourages the business model designer to consider in general what mechanisms a firm requires or uses to deliver its value propositions to its target stakeholders over time, and the attributes of those mechanisms that enable value delivery:

- What channels will you use?
- How will you communicate to your stakeholders, and vice versa?

- How will you deliver your value proposition to your stakeholders?
- How will you initiate, maintain and build your relationships?[50]

Usually a Firm will design a Channel based on the nature of the Relationship Function Time Span, Type and the positive Value Proposition Offering[51] it has determined are best suited to meeting each Target Stakeholder Actor's Needs. For example: to start a relationship requires the stakeholder and firm be able to recognize (search / find) each other as potentially being able to provide mutual value. This is likely to require a different channel than the physical delivery of a product from a firm's inventory store to a customer premise (e.g. retail location, Canada Post, etc.).

Channels comprise a number of Links. While conceptions of Channels is likely to be somewhat generic, each firm's (detailed) conception of its Channels is likely to be unique to its Value Propositions.

Since the BMO only conceptualizes customer stakeholder the BMO conception of a channel only relates to the delivery of customer oriented value propositions (Explained at some length in Osterwalder, 2004a, p.63). As a result of the SSBMO including all relevant stakeholders, the SSBMO conception of channel includes the mechanism to deliver any and all value propositions to any and all target stakeholders.

For example a firm and a supplier stakeholder will form a relationship, possibly formalized in a partnership, for the purchase of a resource. The value proposition the firm offers to the supplier will include fair monetary compensation and social benefits (e.g. recommendations, help problem solving, etc.) in return for specified quantities and qualities of the desired resource. In this case the purchasing function (department) of a firm becomes the channel for this supplier value proposition and channel links will include the necessary physical movement of the resource, payment, etc. The purchasing function is ensuring the focal

[50] Compare this to the Relationship entity which focuses on who the relationships are between, why they exist, and whether they successful (measured by changes in Relationship Equity).
[51] Note that the channels for delivery of negative value propositions are perhaps rarely consciously designed!

firm's needs are met by convincing the 'best' other firms of the value to them of becoming its legitimated supplier stakeholder (Pagell & Wu, 2009).

The Channel Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Channel in a business model (as per DDP6). Location can be considered as part of the Social Context of a Channel (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of a Channel (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

7.4.3.9 Link

Name	(Channel) Link
Definition	Relevant mechanistic components of a Firm Channel through time. Each Link describes a mechanism that delivers a Firm Value Proposition Offering that meets a Firm Target Stakeholder Criterion and helps to fulfill a Firm Relationship Function. Together these components form the mechanisms of a Channel.
Related to (including cardinality of relationship)	Link *is constrained by* Environment (1,1), and *occurs within the context of* Society (1,1) and Financial Economy (1,1) Link *occurs within the context of* Firm Stakeholder Perspective (1,n) (i.e. a Channel Link may be shared by many Firms) Link *meets* Criterion (1,n) Link *connects to another* Link (0,n; 1,1) (Links may be related to other Links over time in a single Channel). Link *has* Valuation Method (0,1) (Note optionality) Link *is provided by* Firm Process (1,n) Link *is a* (Value Proposition) Offering (0,1) (Note optionality) Link *helps realize* (Relationship) Function (1,1) Link *part of* Channel (1,n)
Cardinality	0,n
Attributes	Name (Identifier) = All characters Description = All characters Purpose = { "Awareness" | "Requirements" | "Specification" | "Evaluation" | "Transact" | "Post-Transaction" }[52] | Value Proposition Offering Stage (Channel Link Purpose takes on values from Offering Stage attribute if Link is an Offering) [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]

[52] "Awareness" | "Evaluation" | "Purchase" | "After Sales" are the possible values the Customer Buying Cycle attribute of the Channel Link element that is inherited by the Relationship Mechanism element from the Channel Link element of the BMO (Explained at some length in Osterwalder, 2004a, pp.65-67). The label "purpose" is used for this attribute in the SSBMO, i.e. the purpose of a Channel Link in helping to fulfill a Relationship Function.

References	(Osterwalder, 2004a, Table 26 pp.64-67) DDP5

Table 7-33: (Channel) Link

Typically the mechanisms through which a value proposition is delivered to a target stakeholder are complex. The mechanisms need to change over time as Relationship Equity changes with the associated Relationship Function Time Span and Type. The Channel Link entity is used to describe these detailed mechanisms for each Channel.

The Channel Link:

- Purpose attribute gives the business model designer the opportunity to consider the objective of each of the detailed mechanisms that deliver individual Value Proposition Offerings that meet Target Stakeholder Criterion as the Relationship Functions change over time.

  Unlike the BMO that only considers the purpose of Channel Links in relation to meeting customer stakeholders' criterion (explained at some length in Osterwalder, 2004a, pp.65-67) the SSBMO conceives of the channel links required for any type of stakeholder.

- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Channel Link in a business model (as per DDP6). Location can be considered as part of the Social Context of a Channel Link (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of a Channel Link (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

Channel Links are provided by the processes of one or more organizations within the business model. Some Channel Links are provided by the processes of the focal firm (so called 'direct channels'). Some Channel Links are provided by other organizations, often as a result of a formal partnership (so called ‘indirect channels’). Hence a Channel Link may be shared between Firms.

For example a consumer product manufacturer’s retail channel may consist of two links

1. An on-line store that only sells its own products (that it owns and operates)
2. A brick-and-mortar retailer (who provides a channel link for many manufacturers’ products).

Further, each Link must support a Relationship Function’s Time Span and Type, i.e. a Link’s purpose defines how each part of a Channel and its Links relates to growing Relationship Equity over a particular Relationship Function Time Span. The Channel Link Purpose attribute allow the business model designer to describe how a Channel Link helps realize the desired growth in Relationship Equity specified by the Relationship Function Type and Time Span. Table 7-34 suggests a list of possible Channel Link Purposes that it is recommend the business model designer consider. This list of possible values was synthesized from the literature (Chapters 3 and 4).

The Purpose of each Link in a Channel may be identical or different. Continuing the example, the on-line store may have the purposes of enabling awareness and subsequently facilitating a transaction. Whereas the brick-and-mortar store may have the purpose to help with evaluation, and subsequently facilitating a transaction (it is currently difficult to evaluate many aspects of physical products in a virtual environment, e.g. smell, texture).

Channel Link Purpose	Examples
Awareness	Sharing and gaining general understanding of firm and its value propositions
Requirements	Mutual learning about stakeholder criterion relative to this firm's value proposition offerings
Specification	Mutual requesting of specific combinations of existing or entirely new value proposition offerings
Evaluation	Mutual determination of whether value proposition offerings meet criterion
Transact	Transfer, Buy, Sell, Lend, Borrow, Share, Give, Donate
Post-Transaction	Feedback, Use, Experience, Service, Repair, Return, Replace

Table 7-34: Possible Channel Link Purpose Attribute Values

Further each link helps realize a particular combination of Relationship Function Time-Spans and Types. For example: to start a transaction Relationship with a customer Target Stakeholder via a retail Channel, might require three Channel Links:

1. A web site to help a customer stakeholder become aware of a value proposition offering, and if they do not wish to conduct a physical evaluation, to transact (purchase).
2. A brick-and-mortar location for physical evaluation and transaction (purchase)
3. A maintenance service conducted at customer premise for post-transaction value proposition offering (repairs and upgrades).

A Channel Link, as the mechanism for the delivery of a value proposition offering, may of itself have no value for the related stakeholder. But in many cases the mechanism of value delivery has value in its own right and thus may be identical to a related Value Proposition Offering. Such Channel Links more directly help fulfill a Relationship Function, contributing directly to Relationship Equity (Explained at some length in Osterwalder, 2004a, pp.64-65 & p.67).

Finally, since a Channel Link may create value for a Target Stakeholder by meeting one or more of their Criterion, it may be appropriate to determine how this value it may be measured or realized in monetary, social or economic terms using an associated Valuation Method.

7.4.4 Product, Learning & Development Perspective Entities

7.4.4.1 Introduction and Overview

Based on the overall and detailed design principles, the SSBMO includes the overall idea that a firm's current and future value propositions have the potential to both create and destroy value for their stakeholder actors. This extends the conceptions in the BMO which only considers the positive value that a firm desires to create in current time frames for its customer stakeholders.

In addition to the works cited by Osterwalder (2004a, pp.48-58) the works cited in Chapters 3 and 4 from which the design principles were derived provide theoretical support for this amended conception of the entities within the Product, Learning & Development Perspective of a strongly sustainable business model.

Together instances of the specific entities within the Product, Learning & Development Perspective describe "what a firm does do now and in the future".

7.4.4.2 Value Proposition

Name	Value Proposition
Definition	A declaration of what a Firm does that ● Meets Needs of Target Stakeholder Actors (creating value) ● Fails to enable or allow Target Stakeholder Actor Needs to be met (destroying value) ● Creates Tri-Profit via a Valuation Method that determines a quantity of environmental, social and/or monetary Revenue, Cost or Asset. A Firm's Value Propositions are designed, prepared and delivered by a Firm's Processes.
Related to **(including cardinality of relationship)**	Value Proposition *is constrained by* Environment (1,1), and *occurs within the context of* Society (1,1) and Financial Economy (1,1) Value Proposition *occurs within the context of* Product, Learning & Development Perspective (1,1) (i.e. relates to a specific Firm) Value Proposition *creates* or *destroys value for* Target Stakeholder (1,n) Value Proposition *is delivered via* Channel (1,n) Value Proposition *consists of* Offering (0,n) (Note optionality) Value Proposition *made possible by* Value Configuration (1,1) (i.e. Value Proposition is *created by* and subsequently *delivered by* a Value Configuration) Value Proposition *settled on by* Decision (1,1) Value Proposition *provided by* Capability (0,1) (Note optionality) Value Proposition *depends on* Partnership (0,n) (Note optionality) Value Proposition *enabled by* Relationship (1,n) Value Proposition *creates* or *destroys value for* Target Stakeholder Actor, by meeting or failing to meet one or more of the Actor's Needs.
Cardinality	1,n
Attributes	Name (Identifier) = All characters Description = All characters [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]

Name	Value Proposition
References	(Osterwalder, 2004a, Table 20 pp.49-50) DDP4 DDP5 DDP6 (Conroy, 2007; Denning & Dew, 2012; Hart & Sharma, 2004)

Table 7-35: Value Proposition

The Value Proposition entity encourages the business model designer to consider what a firm does to create and destroy value for all its stakeholders:

- What are your organization's (positive and negative) value propositions for each stakeholder?

Value propositions consist of a number of Offerings which record the detail of each Value Proposition.

The BMO only conceptualizes a customer stakeholder so the BMO conception of a value proposition only relates to the positive value which the firm believes its customers will value in the very near term and primarily monetarily, i.e. 'what will customers pay me for today' that will create financial revenues and perhaps profit for the firm. In other words Value Propositions are designed to have high near term monetary revenue and profit maximizing potential (explained at some length in Osterwalder, 2004a, pp.48-50).

The SSBMO broadens this idea in four ways. The SSBMO conceptualizes that:

1. All value that a firm delivers relate to satisfying one or more of the Needs of the Stakeholder Actors of the organizations involved in the business model.
2. Needs can be satisfied through environmental, social and / or monetary Value Propositions.

3. Value Propositions might destroy value for one or more Stakeholder Actors, i.e the satisfier would be perceived negatively, harming a Stakeholder Actor's ability to meet one or more of their Needs.
4. Some Stakeholder Actors have Needs that can be fulfilled by the continued existence of the firm, not simply what the firm does today.

Hence the SSBMO includes all relevant Target Stakeholders, a broad understanding of those Stakeholder Actor's Needs (described earlier), and the idea that all a firm's Value Propositions, both positive and negative, should be considered.

For example, the SSBMO encourages the business model designer to consider:

- For whom does your firm create value? ("Who do you do it for and with?")
  - Why would an actor wish to become and remain your customer stakeholder?
  - Why would another organization wish to enter a partnership with you and become your supplier?
    - How does a potential supplier answer all these questions about the value they provide to all their stakeholders?
    - What value can we provide a supplier to help them give better answers to all these questions?
  - Why would a person wish to become and remain an employee?
  - Why would an investor wish to invest in and remain invested?
  - Why would a community wish to host your firm's operations (buy, make, deliver, sell / take-make-waste / borrow-use-return etc.)
  - Why would a stakeholder want your firm to continue to exist for a long time?

- For whom does your firm destroy value? (“Who do you do it to?”)
    - Is this unavoidable? (i.e. irreconcilable differences in world-views leading to different conceptions of value creation and destruction).
    - Has your firm decided to recognize the actors for whom value is destroyed as legitimate stakeholders?
- How do you describe the value your firm creates and destroys? (“What do you do now and in the future?”)
- What relationships does your firm desire to have with its legitimated Stakeholder Actors?
    - How will stakeholders you wish to have a relationship with find and interact with your firm?
    - How will your firm maintain or deepen the relationship equity in each of its desired relationships over time?
- Which actors have you chosen not to legitimate as stakeholders, but who may choose to negatively impact your firm?
- How can the needs of un-legitimated stakeholders, or needs of legitimate stakeholders not currently (fully) satisfied be met in the future (“What do you do in the future?”)

The SSBMO conceives of a Value Position as ‘positive’ (creates value) or ‘negative’ (destroys value). The value a Value Proposition creates or destroys may be the same for one or more stakeholders, or it may vary between stakeholders (Denning, 2012).

For example, a mining company which decides to move from underground mining to ‘mountain top removal’ (open cast) mining may be creating social value for actors who are employees (open cast minding generally has a better health and safety record than underground mining), but destroying environmental value for community stakeholders through the despoiling of the landscape, water courses, etc. An individual human actor may be both an employee stakeholder and a community stakeholder! This sets up the potential that within a single stakeholder group, community, there will be different world-views about whether the move to open cast mining is seen, on balance, as creating or destroying value. Community members who are employees and their immediate families may place more importance on the decreased risk of employee injury. Community members who are hunters or who gain other benefits from the landscape may place more importance on this aspect. Actors who are both hunter community stakeholders and employee stakeholders may be split in their opinion of the net benefit of the move to open cast mining.

As this example illustrates, a business model is unlikely to make everyone happy because, at a minimum, different actors may have different world-views. These various world-views will inform their understanding of how any single satisfier (a firm's value proposition) will create or destroy value for them.

Hence business model designers need to decide what positive and negative value propositions are acceptable to the legitimated stakeholders of a firm based on those stakeholders' decisions rights and the resultant definition of firm success (the Measurement Perspective).

For positive value propositions, as discussed in 7.4.3.7 and described in some detail by Osterwalder (2004a, pp.42-78), a firm may use processes based on the knowledge of marketing and sales to proactively find, start, maintain and end relationships with actors (who as a result become a firm's legitimated Stakeholders). This can help ensure that a firm whose value propositions meet's some of the Needs of some group of Actors can be found, gain legitimate stakeholders of all types, and hence be successful.

For negative value propositions, there is a process which can be thought of as the equivalent to marketing and sales, i.e a stakeholder attempting to convince a firm, rather than a firm attempting to convince a stakeholder! This process can result in an actor who is not considered a legitimate stakeholder impacting a firm negatively, as perceived by some of its legitimated stakeholders. Some NGO actors, take such approaches in order that they can become legitimated stakeholders (Conroy, 2007).

Such an impactful actor may choose such actions:

- As retaliation against the firm creating negative value
- With the aim of causing a firm to stop creating negative value
- With the aim of causing a firm to recompense the actor for the perceived harm
- With the aim of causing a firm to stop creating negative value and create a value the actor perceives as positive
- Or any combination of the above.

Since intuitively this process is one of marketing and sales (albeit with the typical players' roles reversed), broadly it consist of a similar sequence of steps: awareness, education, decision, and action (inspired by Conroy, 2007).

This is a currently an unusual perspective, but because such processes are a considerable source for sustainable business model innovation (Hart & Sharma, 2004) it is described here in some detail:

1. Awareness. The actor becomes aware of the impact of a firm's value destruction upon them, i.e. of a need which is not being met or can no longer be met (7.4.3.3). In the case of a non-human, a human actor becomes aware of the impact of a firm's value destruction on a non-human whose need to flourish they consider a need, and chooses to represent that non-human. It is at this point that such actors become impacted stakeholders, whether or not they have been legitimated.

2. *Education*. Awareness is usually not sufficient for an actor to determine the actor(s) and processes that are destroying value for them.

   Often an actor will need to gain tacit and explicit knowledge to make this determination. For example often proximal causes of value destruction are not their ultimate cause. It often takes considerable research to sort one from the other and determine the point of intervention with highest leverage (Meadows, 1999).

3. *Decision.* Once an actor is aware and educated they will then decide on a course of action. This is sometimes known by activists as 'becoming empowered'.

   Often a large number of actors will become educated and then for a variety of reasons decide not to act. Business model designers need to carefully consider under what conditions such a group may take power and realize their latent power, negatively impacting the firm.

   A business model designer may choose to proactively legitimate such actors, establishing relationships with them to mitigate this risk.

4. *Action.* If an actor individually or collectively chooses to proactively bring their grievance to a firm, they have become an impacting target stakeholder, whether the firm has legitimated them or not.

Of course these steps apply equally to NGOs unhappy at a firm's environmental or social impacts as a customer stakeholder who has had a poor experience of a firm in delivering its intended value proposition. For example, customer stakeholder actors have some awareness and education of how their relationship with a firm is meant to enable one or more of their needs to be met (often informed by the firm's own marketing and sales messaging). Further, often unhappy customers will decide to act – but their action may or may include to contacting the firm directly. But, whether or not they contact the firm unhappy customers still have the potential for negatively impacting a firm by acting to mention their grievance to other existing and potential customers[53].

If a firm's legitimated stakeholders include actors whose needs embrace a concern for monetary cost efficiency and / or a flourishing biosphere, and these stakeholders have the

[53] It is often asserted that a customer who has a good experience is likely to tell one other person about it, if the topic 'happens to come up in conversation'. But a customer who has a poor experience will proactively tell 10 other people in great detail about how wronged they feel. Further only 1% of these unhappy customers will choose to take up their complaint with a firm. This can lead to large numbers of customer stakeholders who perceive a firm's value propositions as failing to create the value promised. This in turn can be felt as destroying value related to needs for respect and identity. Customer stakeholders therefore may also become impacting stakeholders by organizing a (social media) campaign against a firm, or simply choosing to take their custom elsewhere.

requisite decision rights, a business model designer will also wish to consider these additional aspects of the value propositions:

- The amount, sources and sinks of the embodied energy in the creation, use and end of[54] each Value Proposition (part of the Value Configuration in the Firm Process Perspective that makes each Value Proposition possible).

  Energy is not modelled directly in the SSBMO: all human use of all energy requires some combination of Biophysical Stocks and Eco-systems Services (both of which are modelled, see 7.4.5.7 and 7.4.5.10)[55].

- The amount, sources and sinks of the Biophysical Stocks contained in and transformed by the creation, use and end of each Value Proposition (part of the Value Configuration in the Firm Process Perspective that makes each Value Proposition possible).

- The use of flows from, and the impact on the enabling structures and processes of the Eco-Systems Services required for each Value Proposition (part of the Value Configuration in the Firm Process Perspective that makes each Value Proposition possible).

If a firm's legitimated stakeholders include actors whose needs embrace a desire for the continued existence and flourishing of a firm, and these stakeholders have the requisite decision rights, a business model designer will also wish to consider value propositions that can meet these future oriented needs.

It is such value propositions that drive the requirements for a "change the business" business process. Recognizing the only constant is change (3.4.6.1), if there were no stakeholder actors who had a need for the firm to continue to exist and flourish, a firm would never have

[54] There is no 'end' for matter in a materially closed semi-open system such as Earth. Even energy, to which the Earth is largely open, can have considerable impact as it does work to degrade from high to low quality.
[55] While using renewable energy does not require an on-going flow of biophysical stocks (e.g. hydro-carbons or fissionable materials), it most certainly requires considerable biophysical stocks and eco-system services to create, maintain and decommission the machines to access the renewable energy flows.

a need to change: it could ‘simply’ continue to offer its existing value propositions delivered by its “run the business” processes.

Such future oriented value propositions can satisfy Actor Needs for a firm to continuously improve overall environmental, social, or monetary outcomes, effectiveness and / or efficiency. Such value propositions are important to firm survival and flourishing in a world where environmental and social change is a constant. Humans will continue to respond to such change by using their ingenuity (in the face of their ultimate laziness Allen, 2003), to better meet their needs through changed:

- Technologies. For example improvements in levels of embodied or in-use energy and materials intensities.
- Law or regulation. For example a carbon tax, extended provider/producer responsibility legislation, or the lifting of a regulation that requires the use of a less efficient or effective technology (Porter, 1991; Porter, 2010).
- Social norms. For example customers being willing to buy a service rather than a product to meet their needs or stakeholders who choose to behave in ways more aligned with the “Natural Laws of Sustainability” (Doppelt, 2012).

As introduced in 7.3.3.6, such future oriented value propositions (“what you do in the future”) cannot themselves contain the new future value propositions (that would be predicting the future). However, what can be described is the Value Propositions, Offering, and Firm Process Perspective that a firm will undertake to change itself over time. For example, proactive customer or other stakeholder feedback capture processes feeding into the processes that develop and test future value propositions.

Further, the process of continuously improving the change the business process may also be described (i.e. double loop learning, which leads to the improvement of the “change the business” process). This allows concepts such as the firm’s approach to becoming and remaining a “Learning Organization” to be described (Senge, 1990; Senge et al., 1999).

Of course a firm may find it helpful to use the SSBMO as a tool to help it efficiently execute its change the business process (RO2) by using it to design and describe its future high quality business model, and hence deliver the future oriented value propositions (RO1)!

Finally, the Value Proposition Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Value Proposition in a business model (as per DDP6). Location can be considered as part of the Social Context of a Value Proposition (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of a Value Proposition (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

7.4.4.3 Offering

Name	(Value Proposition) Offering
Definition	Relevant attributes of each Firm Value Proposition through time. These attributes define, for given Time-Spans in a Firm Relationship with a Target Stakeholder, the value to be put forward by the Firm to that Target Stakeholder.
Related to (including cardinality of relationship)	Offering *is constrained by* Environment (1,1), and *occurs within the context of* Society (1,1) and Financial Economy (1,1) Offering *occurs within the context of* Product, Learning & Development Perspective (1,1) (i.e. relates to a specific Firm) Offering *fulfills* (Relationship) Function (1,1) Offering *is delivered via* (Channel) Link (0,n) (Note optionality) Offering *has* Valuation Method (0,1) (Note optionality) Offering *made possible by* Activity (i.e. Value Proposition Offering is *created by* and subsequently *delivered by* a Value Configuration Activity) Offering *depends on* Agreement (0,n) (Note optionality) Offering *is part of* Value Proposition (1,n)
Cardinality	0,n

<table>
<tr><th>Name</th><th>(Value Proposition) Offering</th></tr>
<tr><td>Attributes</td><td>Name (Identifier) = All characters

Description = All characters

Utility = { { “Use Benefit” | “Risk Reduction” | “Effort Reduction” } | { “Use Harm” | “Risk Increase” | “Effort Increase” } }[56]

Reach = “Local within” <0…n> “km” | “Regional within” <0…n> “km” | “National” | “Trading Zone” | “Global” “with respect to” <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { Latitude, Longitude, Elevation }>

Type = “Me-too (Imitative)” | “Innovative Innovation” | “Excellence Innovation”[57]

Stage = { “Requirements” | “Establishment” | “Realization” | “Renewal” | “Transfer” }[58]

Monetary Value Level (Price) = “Free” | “Economy” | “Market” | “High End”[59]

Social Value Level = { “Flourishing” | “Languishing” | “Survival” } | “Death”

Environmental Value Level = { “Contributory” | “Destructive” } | “Neutral”</td></tr>
</table>

[56] “Use” | “Risk Reduction” | “Effort Reduction” are the possible values of the Reasoning attribute of the Value Proposition Offering element that may be inherited by the Relationship Mechanism or Channel Link elements from the Value Proposition Offering element of the BMO (explained at some length in Osterwalder, 2004a, p.51, pp.64-65 & p.73). The label “utility” is used for this attribute in the SSBMO, i.e. the nature of the benefit or harm a stakeholder is intended to gain from this value proposition offering. The possible values of this attribute unsurprisingly align well with the Partnership Agreement Utility attribute.

[57] “Me-too” | “Innovative Innovation” | “Excellence Innovation” are the possible values of the Value Level (Customer Utility) attribute of the Value Proposition Offering element that may be inherited by the Relationship Mechanism or Channel Link elements from the Value Proposition Offering element of the BMO (explained at some length in Osterwalder, 2004a, pp.51-52, p.67 & p.77). The label “type” is used for this attribute in the SSBMO, i.e. the nature of the offering in comparison to other offerings by this or other firms (competitors).

[58] “Creation (Requirements)” | “Purchase (Acquisition)” | “Ownership Use” | “Ownership Renewal” | “Transfer (Retirement)” are possible values of the Life Cycle attribute of the Value Proposition Offering element that may be inherited by the Relationship Mechanism or Channel Link elements from the Value Proposition Offering element of the BMO (explained at some length in Osterwalder, 2004a, pp.54-56, p.67 & p.77). The label “stage” is used for this attribute in the SSBMO, i.e. the stages of a Relationship with a Target Stakeholder to which the Offering applies.

[59] “Free” | “Economy” | “Market” | “High End” are the possible values of the Price Level attribute of the Value Proposition Offering element that may be inherited by the Relationship Mechanism or Channel Link elements from the Value Proposition Offering element of the BMO (explained at some length in Osterwalder, 2004a, pp.53-54, p.67 & p.77). The label “Monetary Value Level (Price)” is used for this attribute in the SSBMO to disambiguate it from the Social Value and Environmental Value attributes.

Name	(Value Proposition) Offering
References	(Osterwalder, 2004a, Table 21 pp.50-56) DDP5 DDP6 (Max-Neef et al., 1991, pp.33-36)

Table 7-36: (Value Proposition) Offering

A Relationship Function describes the attributes required to maintain and grow Relationship Equity over time (7.4.3.7). A Channel Link describes the mechanistic components of a Channel required to deliver a Value Proposition over time (7.4.3.9). Similarly, a Value Proposition Offering describes the attributes of a Firm's Value Proposition to be put forward to meet Target Stakeholder Criterion over time.

For example the offering used to help a customer learn about a value proposition will be different from the offering that subsequently transacts with the customer (selling), and different again from the offering that continues to provide value via a post-transaction service.

In this way a Value Proposition Offering describes how a Relationship Function will be fulfilled over time, maintaining or changing the Relationship Equity between a Firm and its Stakeholder. The change in Relationship Equity is achieved by the delivery of the Offering via a specific Channel Link.

It is important for the business model designer to consider

- What Offerings are required within each Value Proposition to change Relationship Equity and fulfill each Relationship Function
- How the Offering will be delivered via a Channel Link, and whether the mode of delivery is also of value to the stakeholder.

The Value Proposition Offering:

- Utility attribute gives the business model designer the opportunity to consider the reason an Offering meets the Target Stakeholder Criterion, i.e. how the offering is intended to satisfy a Target Stakeholder Actor Need, resulting in growing Relationship Equity.

  Unlike the BMO, which only considers positive reasons why a customer stakeholder would find an offering valuable, the SSBMO conceives of the utility of a value proposition for any Target Stakeholder and Offering as being positive (creating value) or negative (destroying value).

  Further the SSBMO assumes that multiple positive or negative utilities may be applicable to a single Offering, i.e. an offering may provide a use benefit, harm a stakeholder directly ***and*** increase their risk for future harm (e.g. smoking). Of course some groups of legitimated stakeholder for some firms consider this acceptable, on balance creating more value than is being destroyed!

- Reach attribute gives the business model designer the opportunity to consider the intended geographical area (social) and / or geo-spatial locations (environmental) within which the offering is made.

  Business model designers must carefully consider what the reach of an offering is defined in respect to, i.e. is it local to fixed or variable geographic location – such as the location of a specific stakeholder (or group of stakeholders), or an area in which stakeholders may be found, or the facilities of the firm, or is it local to a fixed geo-spatial location or area.

- Type attribute gives the business model designer the opportunity to consider the nature of the innovation of an offer compared to other offers made by a firm or other firms attempting to meet similar Actor Needs[57].

  As Osterwalder highlights, this is critical in profit-first oriented markets where competition rather than collaboration is the norm (Osterwalder, 2004a, pp.51-52).

- Stage attribute gives the business model designer the opportunity to consider, for each Offering to which periods of a Relationship with a Target Stakeholder it applies.

  Unlike the BMO, which only considers the Offering stages within a Value Proposition that might apply to customer stakeholders, the SSBMO generalizes to consider the stages of an offering relevant for any stakeholder.

- Value level attributes gives the business model designer the opportunity to consider for each offering the nature of the value it is intended to create.

  Unlike the BMO, which only considers the monetary price level of an offering in comparison to extant economic conditions, the SSBMO generalizes to consider value from an environmental, social and monetary perspective.

As noted earlier, an offering can be a Channel Link when the mechanism of value delivery in of itself has value and meets a need of a stakeholder. Locality of a Channel Link is a good example of a Channel Link attribute that may have value irrespective to the value being delivered at that location. Hence this may drive two separate offerings: one concerned with what is being delivered, and one, concerned with the Channel Link, i.e. where is the value being delivered with relationship to the customer stakeholder (7.4.3.9).

The choice of Offering Type has no implicit higher or lower / best or worse contribution to an offering. This is particularly true when Offering Type is considered in relationship to the Reach of an Offering. A imitative offering made locally have more value for a stakeholder for whom more value is created by local satisfiers than through an identical offering made by other more geographically distant firm channels. Such a local satisfier may generate satisfaction for stakeholders directly, i.e. increased convenience and / or participation in the local community, or in monetary terms, i.e. due to lowered transportation costs for the firm (perhaps subsequently embedded in its prices).

As noted earlier, concepts and techniques of customer oriented marketing and sales from which Osterwalder derived his Offering Life Cycle attribute appear applicable to other stakeholders and for both positive and negative value propositions (7.4.3.7, 7.4.4.2). This observation was used to derive the suggested possible values for the Offering Stage attribute.

Table 7-37 compares the BMO customer Offering Value Life Cycle attribute values to the SSBMO Offering Stage attribute values applicable to any stakeholder synthesized from the literature (Chapter 3 and 4).

SSBMO Value Proposition Offering Stage Attribute Values	**BMO Value Life Cycle Attribute Values**
Requirements	Creation (Requirements)
Establishment	Purchase (Acquisition)
Realization	Ownership (Use)
Renewal	Ownership (Renewal)
Transfer	Transfer (Retirement)

Table 7-37: Comparison of Possible Value Proposition Offering Stage and Value Life Cycle Attribute Values

The possible values of the Monetary (Price) Value Level attribute are taken directly from the BMO without change. When a business model designer is choosing the Monetary Value Level of an Offering they should consider that the same Stakeholder with different Criterion will view the same Offering as creating positive or negative value based on these Value Level attributes. For example a customer stakeholder whose criterion includes monetary affordability will find an offering with a High End Monetary Value Level of little overall value (or possibly making things worse for them by creating feelings of inadequacy, which can drive the counterfeit market for 'luxury' goods). The same offering for a customer stakeholder whose criterion is unconcerned with monetary price, or for whom monetary price helps to satisfy an identity need, may find this offering of high overall value.

Turning to the Social and Environmental Value Levels, there was no research found that directly suggests Value Levels for these contexts. However, the shared (K0) and strongly-sustainable (K0-SS) literature did indicate the validity of the idea that social and / or environmental value levels exist (4.4 and 4.6).

Table 7-38 synthesizes from this literature possible values for Social Value Level that a business model designer may wish to consider in light of the intended positive or negative value of each offering.

Value Proposition Offering Social Value Level	**Description**
Flourishing	An offering is directly attempting to satisfy an Actor Need that is a pre-condition for them to flourish, e.g. the offering employs only “singular or synergistic satisfiers” to meet needs (Max-Neef et al., 1991, Table 5 & 6 p.36)
Languishing	An offering that does not enable flourishing, but that concerns needs which are associated with something other than ‘mere survival’, e.g. the offering may employ any type of satisfier (Table 5 & 6 p.36)
Survival	An offering that enables survival and no more, e.g. the offering may employ any type of satisfier (Table 5 & 6 p.36)
Death	An offering that is implicated in causing death, e.g. the offering may employ violator, destroyer, pseudo, or inhibiting-satisfiers (Table 2 p.23, Table 3 & 4 p.35)

Table 7-38: Possible Value Proposition Offering Social Value Level Attribute Values

Table 7-39 synthesizes from the literature possible values for Environmental Value Level that a business model designer may wish to consider in light of the intended positive or negative value of each offering.

Value Proposition Offering Environmental Value Level	Description
Contributory	This value level describes offerings that enable ecosystem flourishing (elaboration) (4.4.3.2), recognizing 'restoration' of an environment is conceptually impossible, there being no privileged state for the environment at any point in time, past present or future,
Destructive	Any offering that hinders ecosystem flourishing, decreasing elaboration.
Neutral	Offerings attempting 'zero-impact' on all ecosystems (Sipkens & Thrum, 2012)

Table 7-39: Possible Value Proposition Offering Environmental Value Levels Attribute Values

7.4.4.4 Reflection on and Example of Relationships between Entities Generalized by Product, Learning & Development and Firm Stakeholder Perspectives

The profit-first ideas related to products and customers are complex with a significant body of associated management, marketing and organizational scholarship. Osterwalder used the term "customer interface" from the business model literature for product and customer portion of a profit-first firm's business model ontology (Osterwalder, 2004a, p.42).

In addition to the capture and coding of each of the necessary concepts and their relationships in the BMO, Osterwalder felt the need to illustrate how the concepts inter-related through a number of examples.

The reader is directed to Osterwalder's examples listed in Table 7-40 to understand the complexity inherent in the 'simple' profit-first world-view of these concepts. The reader is reminded that all this is, as per ODP2, still valid in the SSBMO. Hence all of Osterwalder's examples are also valid for the SSBMO.

SSBMO **Entity & Attribute** (if applicable)	**Relevant BMO** **'Illustration', 'Theory' or '(Mini) Case Study'** (All references in table are to Osterwalder, 2004a)
Firm Stakeholder and Product, Learning & Development Perspective	Montreaux Jazz Festival (MJF) Case Study (pp.106-103), includes: ● Overview of the whole MJF business model described using the BMO (Illustration Box 3 p.49) ● A number of specific examples categorized below
Firm Stakeholder Perspective	Mini-Case Orange Mobile Switzerland (pp.77-78), includes: ● Examples of the instances of Relationship and Relationship Function showing the values of each of the attributes (Fig.38 p.78)
(Relationship) Function Type	Examples of Types of Relationship Function: ● Building trust mechanisms at eBay.com (Illustration Box 5 p.76) ● Building identity (brand) at Nestlé and Nokia (Illustration Box 6 p.77)
Channel and (Channel) Link	● Four Outcomes Model illustrating the theoretical relationships between products, consumers and intermediaries (i.e. channels) (Theory Box 4 p.62) ● Example of Barnes and Noble's Channel Strategy showing the relationship between the instances of the Channels and Channel Links (organized by Purpose) (Fig.35 p.69) ● Example of Nokia's Channel Strategy showing the relationship between the instances of the Channels and Channel Links (organized by Channel Link Purpose) (Fig.37 p.70) Example of MJF instances of Channel and Channel Link associated values of each of the attributes (pp.107-107), including: ● MJF Channel Strategy (Fig.55 p.110)
(Channel) Link Purpose	Examples of possible instance values (Fig.32 p.66)
(Channel) Link Purpose and (Relationship) Function Time-Span	Examples of possible instance values (Fig.33 p.67)
Product, Learning & Development Perspective	Digital Product Innovation at Audible (Illustration Box 3 p.49)
Value Proposition	The Case of easyMoney.com (pp.56-58). Includes ● The instances of easyMoney.com's Value Proposition Offerings showing the associated values of each of the attributes (Table 22 p.57), ● The relationship of each Value Proposition Offering instance to its Value Proposition Offering Stage (Fig.25 p.57) ● A strategy canvas for easyMoney.com and its competitors showing the relationship between instances of the Value Proposition Offerings to its Type and Monetary Value Level (Fig.26 p.58) ● A value map for easyMoney.com and its competitors showing the relationship for all the instances of the Value Proposition Offerings between their Types and Monetary Value Levels (Fig.27 p.58)

SSBMO **Entity & Attribute** (if applicable)	**Relevant BMO** **'Illustration', 'Theory' or '(Mini) Case Study'** (All references in table are to Osterwalder, 2004a)
Value Proposition (Continued)	MJF case study, including: ● Instances of Value Proposition and Offerings including associated values of each of the attributes (pp.104-107 incl. Fig.53 & Illustration Box 16) ● Relationship between Value Proposition Offering and Channel Link instances (Fig.54 p.108) ● Values of the attributes of a specific instance of Value Proposition Offering and Channel Link for www.ticketcorner.ch (Illustration Box 17 p.109)
(Value Proposition) Offering Type	Strategy Canvas for Short Haul Airline Industry (Theory Box 2 p.52)
(Value Proposition) Offering Monetary Value Level	Positioning in the Airline Industry: A Value Map (Theory Box 3 p.54)
(Value Proposition) Offering Stage	Value Creation and Customer Participation (Illustration Box 4 p.55)

Table 7-40: Profit-First Examples of Products and Customer Stakeholders

In the SSBMO the Stakeholder and Product, Learning and Development perspectives can be relabelled the 'stakeholder interface' of a strongly-sustainable business model ontology.

To enable the SSBMO to also represent the strongly sustainable world-view (ODP2) and adhere to DDP1-6, many of the stakeholder interface entities and attribute concepts have been broadened. Hence the labels of these entities and attributes have also been suitably adjusted (as described above). Table 7-41 summarizes all these adjustments, with the footnotes included in the text above containing the rationale / explanation for each change.

SSBMO Label		**BMO Label**	
Entity	**Attribute**	**Element**	**Attribute**
Relationship	Equity	Relationship	Equity
(Relationship) Function	Time-Span	Relationship	Equity
(Relationship) Function	Type	(Relationship) Mechanism	Function
(Channel) Link	Purpose	(Channel) Link	Customer Buying Cycle

SSBMO Label		BMO Label	
Entity	**Attribute**	**Element**	**Attribute**
(Value Proposition) Offering	Utility	(Value Proposition) Offering (Relationship) Mechanism (Channel) Link	Reasoning
(Value Proposition) Offering	Reach	Not present	
(Value Proposition) Offering	Type	(Value Proposition) Offering (Relationship) Mechanism (Channel) Link	Value Level (Customer Utility)
(Value Proposition) Offering	Stage	(Value Proposition) Offering (Relationship) Mechanism (Channel) Link	Life Cycle
(Value Proposition) Offering	Monetary Value Level (Price)	(Value Proposition) Offering (Relationship) Mechanism (Channel) Link	Price Level
(Value Proposition) Offering	Social Value Level	Not present	
(Value Proposition) Offering	Environmental Value Level	Not present	

Table 7-41: Summary of Differences between Key SSBMO and BMO Attributes Labels in Stakeholder (Customer) and Product, Learning & Development (Product) Perspectives

As illustrated with the range of examples introduced by Osterwalder (Table 7-40), the BMO is in no way a simple model, attempting, as it does, to provide the ability to describe the considerable complexity of and variation between profit-first firm's "customer interfaces".

As noted in 7.2.1.3, in the SSBMO the conceptions captured and coded in each of the 'stakeholder interface' entities only serve to increase this complexity. Elements of this increased complexity are driven by the idea that ***both*** the profit-first and strongly sustainable world-views of all stakeholders must be considered and that this should be done for all stakeholder actors (ODP2).

Hence, the strongly sustainable business model designer's task now includes the challenge of repeatedly considering stakeholder's feelings and judgements arising from their world-views and experiences. Designing the complex connections between Relationship Equity, Relationship Function Time Span and Type, Channel Link Purpose, Value Proposition Utility, Reach, Stage and Value Level is clearly cognitively challenging.

Further, reflecting critically on this, as per the critical pragmatic philosophical stance of this research (3.2.3.2), a number of possible limitations become apparent. Designing solutions to problems involving concepts such as feeling and judgement are often considerably less tractable using a positivist approach. And yet, this is exactly the philosophical stance of the SSBMO artefact capture and coding formalism: Entity Relationship Modelling.

The ERM approach was conceived as a positivist MIS design science formalism to assist with specification and creation of digital information systems (5.2.6). It's creator argued that

> *The entity-relationship model adopts the more natural view that the real world consists of entities and relationships. It incorporates some of the important semantic information about the real world.* (Chen, 1976)

However, despite this claim, its domain, digital information systems, is not known for its sympathy with the highly fungible and personally variable world-views of firm stakeholders, their needs, relationships, value delivery mechanisms and value propositions.

The strongly sustainable business model designer is encouraged to recognize the limitations of the positivist modelling formalism chosen when, for example, they are designing the combination of Relationship Function Time Span and Type, Channel Link Purpose, Offering Utility, Reach, Stage and Value Levels required in a particular firm's business model.

To assist with these considerations and to close the capture and coding of the entities in the Stakeholder and Product, Learning & Development Perspective generalizations entities (sections 7.4.3 and 7.4.4), an example is presented.

The example is of a portion of the 'stakeholder interface' of the business model for a (necessarily locally) oriented single location street food vendor[60]. The example illustrates how the SSBMO allows the description of relationships, channels and value propositions that might be relevant for a range of stakeholders with a range needs based on a range of world-views for such a firm.

Table 7-42 shows an example of Relationship Function, Channel Link and Value Proposition Offering instances that are intended meet customer Target Stakeholder Criterion[61] for a street food vendor. The value(s) of the attributes in each entity instance is shown.

Table 7-43 continues the same example, showing the possible instances and attribute values that are intended to meet an ingredient supplier Target Stakeholder Criterion (in this case a fresh vegetable vendor), i.e. the value the street food vendor is offering to one of its suppliers.

These examples are simplified: only the positive value propositions are considered for these two stakeholders, and further it is assumed the street vendor's

- Desired customer and all suppliers world-view are strongly sustainable (i.e. not just the food supplier, but the financial institution, information technology and tele-communications providers etc.)
- Customers visit the vendor in person to learn about and order the food (clearly awareness could also be accomplished by a virtual channel, in addition to the physical one described).
- All supplier interactions are virtual (voice, email, web etc.) except for ingredient delivery.
- Prices charged to customers are at market levels (i.e. not economy nor high-end); Prices paid to ingredient suppliers are at high-end levels (reflecting the understanding of the costs to produce local, sustainable food).

[60] i.e. Value Proposition Offering Reach is Local within walking distance of the Customer, and Cargo Bicycling Distance of the Supplier
[61] i.e the Needs of the Actor who is taking a customer Target Stakeholder role with this particular Firm.

- Food and packaging meets current local sustainable best practice
- Energy is renewable
- Packaging will be biodegraded after use (e.g. vendor provides an on-site composter) and returns the compost to the ingredient suppliers.
- Proximate physical environment includes a pleasant environment for customers to eat the food for all weather conditions, to which the vendor contributes (for example, by volunteering with the local parks department, who would then be another organization in the business model)

Entity	Relationship Function		Channel Link	Value Proposition Offering		
Attribute / **Summary of Example Customer Instance Descriptions**[62]	**Time Span**	**Type**	**Purpose**	**Utility**	**Stage**	**Value Level** (E)nvironmental, (S)ocial, (M)onetary
Find and understand food choices offered via a pleasant interaction and environment	Start, Maintain[63]	Build, Learn	Awareness, Requirements	Effort Reduction	Requirements	E: Neutral S: Flourishing M: Free
Quickly place order, receive correct food and pay (and receive correct change)	Start, Maintain	Transact	Specification, Transact	Effort Reduction	Establishment	E: Neutral S: Flourishing M: Market
Eat food in pleasant surroundings	Deepen	Experience	Post-Transaction	Use	Realization	E: Contribute S: Flourishing M: Free
Feedback and recommendations requested and provided via Twitter	Deepen	Involve	Post-Transaction	Effort Reduction	Renewal, Transfer	E: Neutral S: Flourishing M: Free

Table 7-42: Example – Local Street Food Vendor – Customer Interface Design

[62] This column summarizes the name and description attributes of the related instances of the Relationship, Function, Channel, Link, Value Proposition and Offering entities.
[63] For repeat customers or suppliers

Entity	**Relationship Function**		**Channel Link**	**Value Proposition Offering**		
Attribute / **Summary of Example Ingredient Supplier Instance Descriptions**	**Time Span**	**Type**	**Purpose**	**Utility**	**Stage**	**Value Level** (E)nvironmental, (S)ocial, (M)onetary
Find and understand our local sustainable ingredient needs via a pleasant interaction	Start, Maintain	Build, Learn	Awareness, Requirements	Effort and Risk Reduction	Requirements	E: Neutral S: Flourishing M: Free
Send order in timely fashion with valid ingredient descriptions, quantities and prices	Start, Maintain	Transact	Specification, Transact	Effort Reduction	Establishment	E: Neutral S: Flourishing M: Free
Efficient receipt of ingredients at our location with commitment for proactive constructive feedback on match of order to received ingredient quantity and quality.	Maintain, Deepen	Transact Experience	Transact	Effort and Risk Reduction	Realization	E: Neutral S: Flourishing M: Free
Prompt and full payment of full invoice electronically	Maintain, Deepen	Transact	Post-Transaction	Effort and Risk Reduction	Realization	E: Neutral S: Flourishing M: High-End[64]

Table 7-43: Example – Local Street Food Vendor – Supplier Interface Design

[64] i.e. Street Food Vendor is indicating part of their value proposition to their ingredient suppliers is that they are willing to pay above market prices because of the nature of their need for local sustainable ingredients.

7.4.5 Process Perspective Entities

7.4.5.1 Introduction and Overview

Based on DDP5 and DDP6 the SSBMO includes the overall ideas that

- The actors that are legitimated as stakeholders, and the role they may play in the governance of a firm and its business model, impacts value creation and destruction for many of those actors.
- Physical resources are transformed by a firm's business model, and are not created nor destroyed: there is no infinite supply of any matter constrained only by monetary cost; there is no 'away' to which unwanted matter disappears without environmental, social or monetary impact.
- Activities a firm undertakes to make its value propositions possible, particularly those involving the transformation of matter, fundamentally rely on flows of benefits from eco-system services.

These ideas extend the conceptions in the BMO that does not consider any aspect of governance, the ultimate source and sink of physical resources, nor the reliance on eco-system services of any business model.

In addition to the works cited by Osterwalder (2004a, pp.79-95) the additional works cited in Chapters 3 and 4 from which the design principles were derived provide theoretical support for this (re) conception of the specific entities within the Process Perspective of a strongly sustainable business model.

Together instances of the specific entities within the Process Perspective describe "where and with what does a firm do it". Entities within the Firm Process sub-Perspective are related to specific firms within a business model and collectively describe a firm's "run the business" and "change the business" processes. Entities outside the Firm Stakeholder sub-Perspective are not related to any specific firm, and hence are shared by all actors, whether stakeholders of any firm in a business model or not.

In reviewing the BMO conception of and relationships between the Value Configuration, Activity, Capability, Resource, Partnership and Agreement entities, a comparison was made with a broad range of other approaches for describing a firm's business processes (Upward, 2010b). Many of these conceptions originated from the business process reengineering work of Hammer et. al. (Hammer, 1990; Hammer, 1996; Hammer, 1998a; Hammer & Stanton, 1999) and from the self-titled information, communications and technology centric Business Process Management community (van der Aalst, 2005).

Overall, the BMO's approach to modelling business processes is found to be one of, if not the, most comprehensive and flexible approaches encountered. This conclusion was reached based on the author's significant practical knowledge of consulting, as well as experience teaching in the field of business process analysis and design (Upward, 2002).

One significant result of the approach taken is to enable business processes to be modelled with as much or little granularity and detail as is deemed useful by a business model designer. This is a much welcome (and under appreciated) contribution of Osterwalder's original work.

As an example, whether by design or accident, the BMO approach appears far more accommodating than others of socio-technical and human-activity system conceptions of business processes.

7.4.5.2 Decision

Name	Decision
Definition	A judgement involving one or more Target Stakeholders concerning a Firm's Value Propositions made through their participation in one or more Value Configurations (processes).
Related to **(including cardinality of relationship)**	Decision *is constrained* by Environment (1,1) Decision *occurs within the context of* Society (1,1) and Financial Economy (0,1) Decision *occurs within the context of Firm Process Perspective* (1,1) (i.e. Decisions are unique to a Firm) Decision *concerns* Value Proposition (1,n) Decision *involves* Target Stakeholder (1,n) Decision *made through participation in* Value Configuration (1,n)
Cardinality	1,n
Attributes	Name (Identifier) = All characters Description = All characters Type = { "Single Decision Maker" | "Multiple Decision Makers" } { "Unilateral" | "Negotiated" | "Consultative" | "Democratic" | "Consensus" } Role = { "Excluded" | "Informed" | "Consulted" | "Involved" | "Opines" | "Votes" | "Decides" } (Opines includes stakeholder role in consensus or other open governance processes) [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]
References	DDP5 (Al-debei, 2010, p.80; Luftman, 2004; Parhankangas et al., 2005; Weill, 2004)

Table 7-44: Decision

The Decision entity encourages the business model designer to consider questions of power, i.e. the governance arrangements for a firm:

- Which stakeholders get involved in making which decisions about who you do it to for and with, what you do now and in the future, how, where and with what you do it and how you define and measure success (i.e. any and all aspects of your business model)?
- To what extent is each stakeholders involved in each decision? (i.e. relative to other stakeholders, how much formal and informal power does each stakeholder have?)
- Which actors have you chosen not to legitimate as stakeholders (i.e. they have no recognized role in any decision), but who may be impacted or may choose to impact the firm as a result of your value propositions, because of the negative value they create?

The BMO does not conceptualize power, although at least one of the exemplar business ontologies built with reference to the BMO also found it necessary, based on his review of the literature, to add this concept (Al-debei, 2010, p.80).

Business scholars Luftman and Bullen (Luftman, 2004) define governance as concerning power, alignment and process. Table 7-45 illustrates how each of these aspects of governance is conceptualized by the Decision entity.

This conceptualization allows any decision that a business model designer considers important in a business model to be described. Aspects of decisions related to politics (i.e. dogma, persuasion, belief, benefit), role (i.e CEO, shareholders, etc.) or relative power (i.e. some stakeholders having power to make their needs a priority over other actors needs) may all be modelled as required.

Aspect	Scope	Conceptualization in SSBMO
Power	Who can make decisions	Which Actors are legitimated as Target Stakeholders and how much relative ability to influence decision outcomes does each Target Stakeholder have.
Alignment	Why they make them	Decisions are made to change a Firm's Value Proposition based on the 'logic' of a Firm's acceptable definition of success described by the Measurement perspective.
Process	How they make them	'governance arrangements' or 'decision making processes' are activities collected together in a governing Value Configuration.

Table 7-45: Conceptualized Aspects of Governance

The basis, 'governance principles' or governing 'logic' for decisions is established by the acceptable definition of success recorded in the Measurement Perspective entities. Hence, perhaps **the** two key decisions (and hence key value propositions to stakeholders) are the decisions concerning which:

- Stakeholders have rights to decide what other actors will be considered as legitimate stakeholders.
- Of the legitimized stakeholder involved, what is the nature of their involvement in the definition of organization success. (i.e. what rights does each stakeholder have in this decision making process).

Stakeholder decision rights can range from ultimate decision making to advisory. They are typically exercised via legitimized stakeholder's involvement in one or more formal organizational structures and associated decision making processes. These structures may include: boards of directors, workers councils, collective bargaining meetings, grieving committees, shareholder's meetings, customer advisory boards, boards of patrons, stewardship councils, etc.). Other processes may exist within a firm to support or enable these governance arrangements that do not directly involve the stakeholders.

For example a firm's:

- Financial function and the accountants who execute these financial processes are partially there to support the governance arrangements for owner stakeholders (e.g. provision of (audited) statements of financial performance).
- Internal audit function is there to support the governance arrangements for all legitimated stakeholders who care about financial efficiency, effectiveness, and risk to invested monetary capital.

During build activities D1 and D2 (i.e. an iteration through the function, structure, process and context of a business model, as per 5.2.3.5) consideration was given to whether or not formal or informal organizational structures needed to be conceptualized in the SSBMO.

The exemplar business ontology researchers had all omitted to conceptualize organizational structure in their ontologies, without commenting on the basis for the omission. Further none of the shared (K0), profit-first (K0-PF) or strongly sustainable (K0-SS) literature consulted suggested this was relevant for business models. Implicitly scholars appear to believe organization structure can be omitted from a business model because either:

- Organization structure design (i.e. formal 'organizational charts' or informal 'influence maps') is a consideration more detailed (i.e. closer to business operations) than is useful to be included in a business model (i.e. business strategy and architecture).
- Organization structure is 'simply' a formalization or description of power relationships between a sub-set of firm stakeholders (i.e. shareholders, members of boards of directors, corporate officers, executives, managers and workers); hence a conception of governance arrangements is sufficient.

As a result, and following the lead of the BMO, organization structure is not conceptualized in the SSBMO.

The Decision:

- Type attribute gives the business model designer the opportunity to consider the nature of the decision making process: who and how.
- Role attribute gives the business model designer the opportunity to consider the role each stakeholder involved in a decision is to play and hence the transparency of the decision making process and outcome.
- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Decision in a business model (as per DDP6). Location can be considered as part of the Social Context of a Decision (i.e. relative to the location of the involved stakeholders or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of some aspect of a Decision (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

Table 7-46 synthesizes from the literature reviewed possible values for Decision Type that a business model designer may wish to consider for each decision.

Decision Maker / Mode	Single	Multiple
Unilateral	Authoritative	not-applicable
Negotiated	A negotiation (with value creation and destruction) between the decision makers representing the parties involved in the outcome of a decision. Decision is made when the side with more power feels it can impose the combination of value creation and destruction on the other parties.	
Consultative	The decision maker(s) make a genuine inquiry into the value creation and destruction which it is envisaged will result from the decision before imposing the decision.	
Democratic	Not applicable	The decision makers each have a vote. (Super) majority of votes determines decision.
Consensus	Not applicable	The decision makers discuss the value creation and destruction which it is envisaged will results from the decision. If value destruction for one or more parties is considered by one party to be unacceptable, all parties dialog to find solutions which avoid the unacceptable possibility ('dissolving' the problem).

Table 7-46: Possible Decision Type Attribute Values

Table 7-47 synthesizes from the literature reviewed possible values for Decision Role that a business model designer may wish to consider for each decision. Considering which stakeholders are omitted, informed and consulted determines the transparency of the decision making process and outcome.

Decision Role	Description of Stakeholder Role in a Decision
(None)	If a stakeholder is not involved in or omitted from a decision they will not be related to that decision instance; i.e. legitimized stakeholder actors: who have not been legitimized (and hence not involved in any decisions), or who have low relative power levels compared to other legitimized stakeholders
Excluded	A stakeholder has been proactively removed from any role in a decision
Informed	A stakeholder is proactively informed of the result of a decision
Consulted	A stakeholder is proactively consulted during the decision making process, their perspective may be solicited and shared with other stakeholders involved in the decision
Involved	A stakeholder is involved in the decision making process by taking position on the decision and its outcomes.
Opines	A stakeholder is allowed to present their opinion on their preferred decision and its outcomes.
Votes	A stakeholder is allowed a vote
Decides	A stakeholder makes the decision

Table 7-47: Possible Decision Role Attribute Values

7.4.5.3 Partnership

Name	Partnership
Definition	A consciously initiated and formalized arrangement formed between two or more stakeholders concerning co-ordination to enable a Firm's Process.
Related to **(including cardinality of relationship)**	Partnership *is constrained* by Environment (1,1) Partnership *occurs within the context of* Society (1,1) Partnership *sometimes occurs within the context of* Financial Economy (0,1) Partnership *occurs within the context of Firm Process Perspective* (1,1) (i.e. Partnerships are unique to a Firm, but may be related to another Partnership) Partnership *furthers* Relationship (1,n) Partnership *contributes to* Value Proposition (0,n) (Note optionality) Partnership *concerns* Value Configuration (1,n) (i.e. is required to execute a process) Partnership *consists of* Agreements (0,n) (Note optionality) Partnership *is a part of another* Partnership (0,n; 1,1) (Note optionality. The other Partnership may be used to represent the view of the arrangement considered from the opposite permutation of the Firm and Relationship Target Stakeholder) Partnership *furthers a* Relationship (recorded as a change in Relationship Equity) that a Firm *maintains with a* Target Stakeholder *as a result of undertaking* Partnership Agreement. Partnership Agreements describe how the Firm and its Stakeholder will co-ordinate: an Activity, a Resource, or a combination of the two
Cardinality	0,n
Attributes	Name (Identifier) = All characters Description = All characters [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]
References	(Osterwalder, 2004a, Table 34 pp.89-92) DDP5

Table 7-48: Partnership

The Partnership entity encourages the business model designer to consider which relationships need to be formalized in order to enable Firm Processes:

- What formal relationships with which stakeholders are required to deliver your value propositions?
- Who are your partners and what agreements have you made with them?

Partnerships consist of a number of Agreements which record the detail of each Partnership.

While the BMO conceptualizes partnerships, the conception is possibly weak:

- Environmental and most social limitations are not considered.
- Purpose of a partnership is not considered.
- Need for firm's to consider their Partnerships with all types of stakeholders (The BMO did relate Partnership Agreement to Actor, but as noted earlier, the conception of the Actor entity was not fully developed and was dropped from the BMC entirely).
- Need for a firm to consider the value proposition they are offering to a stakeholder as they enter into a partnership.
- View of a partnership from the perspective of stakeholders other than the focal firm is not considered.

These possible weaknesses have been addressed in the SSBMO:

- Environmental and social limitations may be considered using the context generalization entities
- The purpose of partnerships is considered by suggesting every Partnership further the growth of Relationship Equity enabled by a Value Proposition between a Firm and a Target Stakeholder (the other party to an agreement). This use of the mutually agreed equity of the relationship that must underlie every formalized partnership provides the basis for the benefits of each partnership.
- The complete range of partnerships between a firm and any stakeholder may be considered since Relationships include all stakeholders. This allows a firm to

consider the nature of and the desired relationship equity growth in all its formalized relationships:

  - Employment (purchasing effort, skills and / or knowledge from employee and contract worker stakeholders),
  - Resources or service supply (sales contracts with other stakeholders, aka customers)
  - Resource or service acquisition (purchase contracts with other stakeholders, aka suppliers)
  - Co-create / co-provide (with any stakeholders, including customers)

  This implications of this last type of relationship is worth noting: the SSBMO enables the modelling of not simply the design of the creation of customer value (as per the BMO), but also the modelling of all aspects of the relationships, partnerships, and processes by which that value is brought into being in any part of a business network: supplier, focal firm, customer, NGO, government. In contrast the BMO only conceptualized the customer relationships, and the non-customer partnerships and processes.

- The value proposition being offered in each partnership is considered by suggesting partnerships may be related to a value proposition intended to meet the need of any stakeholder.
- The perspective of all parties involved in a partnership may be considered by connecting an instance of a Partnership based on a Relationship between a Firm and Target Stakeholder with an instance of a Partnership between the other stakeholder and the firm. This allows networks of partnership in a business model to be conceptualized.

Some of these changes to the BMO conception of partnership also impact the conception of the SSBMO Partnership Agreement entity (7.4.5.4).

Table 7-49 provides a partial list of possible partnerships a firm will have with one or more target stakeholders.

Firm's Partnership Action	In Return for which Target Stakeholder may…
Supply (transfer ownership to)	Take an in kind action (barter), or make a gift, monetary payment, or investment
Lend[65]	
Receive (transfer ownership from)	
Borrow	
Share	
Collaborate	

Table 7-49: Possible Partnership Instances

Finally, the Partnership Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Partnership in a business model (as per DDP6). Location can be considered as part of the Social Context of a Partnership (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of a Partnership (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

[65] Leases are a specific type of lending.

7.4.5.4 Agreement

Name	(Partnership) Agreement
Definition	Relevant attributes of each Firm Partnership Agreement.
Related to (including cardinality of relationship)	Agreement *is constrained* by Environment (1,1) Agreement *occurs within the context of* Society (1,1) Agreement *sometimes occurs within the context of* Financial Economy (0,1) Agreement *occurs within the context of Firm Process Perspective* (1,1) (i.e. Agreements are unique to a Firm, but may be related to another Partnership) Agreement *contributes to* Offering (0,n) (Note optionality) Agreement *on* Resource (0,n) (Note mutually exclusive optionality with Activity) Agreement *on* Activity (0,n) (Note mutually exclusive optionality with Resource) Agreement *part of* Partnership (1,1)
Cardinality	0, n
Attributes	Name (Identifier) = All characters Description = All characters Utility = { “Gain Privileged Access” | “Efficiency” | “Effectiveness” | “Risk Reduction” }[66] Importance = 0..5[67] Co-opetitor = -5..0..+5[68] Integration = 0..5[69] Co-dependency = -5..0..+5[70] [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> “,” <Longitude> “,” <Elevation> } >]

[66] “Optimization and Economies of Scale” | “Reduction of Risk and Uncertainty” | “Acquisition of Resources” are the possible values of the Reasoning attribute of the Partnership Agreement element of the BMO (explained at some length in Osterwalder, 2004a, p.93 & Illustration Box 12). The label “utility” is used for this attribute in the SSBMO, i.e. the nature of the benefit of a partnership to the Firm initiating the agreement. The possible values of this attribute unsurprisingly align well with the Value Proposition Offering Utility attribute.

[67] This attribute is identical to the Strategic Importance attribute of the Partnership Agreement element of the BMO (explained at some length in Osterwalder, 2004a, p.94). The label has been simplified.

[68] 0..5 are the possible values of the Degree of Competition attribute of the Partnership Agreement element of the BMO (Explained at some length in Osterwalder, 2004a, p.94). The label “co-opetor” (Co-opetitor = co-operator + competitor) and an adjusted range of values is used for this attribute in the SSBMO, i.e. while some

Name	(Partnership) Agreement
References	(Osterwalder, 2004a, Table 35 pp.92-95) DDP5 (Blattberg, 2000, pp.172-184)

Table 7-50: (Partnership) Agreement

Some relationships may include formalized partnerships, consisting of agreements. A Partnership Agreement describes the attributes of a Partnership required to maintain or grow the Equity in the related Relationships. A Partnership Agreement relates agreed terms and conditions to a Resource or Activity that is the subject of the Partnership.

The subject of Agreement is the:

- Provision or co-ordination of 'privileged access to'[71] Resources for a firm to enable the creation or acquisition of Capabilities that contribute to Value Configurations to make a Value Proposition possible.
- Co-ordination of Activities that are a part of a Value Configuration to make a Value Proposition possible.

The Agreement

- Utility attribute gives the business model designer the opportunity to consider the reasons an Agreement will grow the associated Relationship Equity, i.e. how an agreement is intended to satisfy the Target Stakeholder Actor Need.

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partners will sometimes be competitors, as in the BMO's conception of partnership, others will be primarily be co-operators (collaborators).

[69] 0..5 are the possible values of the Degree of Integration attribute of the Partnership Agreement element of the BMO (Explained at some length in Osterwalder, 2004a, p.94 & Illustration Box 13). The label is simplified in the SSBMO.

[70] 0..5 are the possible values of the Substitutability attribute of the Partnership Agreement element of the BMO (Explained in Osterwalder, 2004a, p.95). The label "co-dependency" and an adjusted range of values is used for this attribute in the SSBMO, i.e. while it may be possible to incur only positive value by substituting one partner for another, in many cases significant, perhaps catastrophic harm may be done to a firm and/or its other stakeholders.

[71] Defined after Table 7-51.

The BMO only considers positive reasons why a firm would enter into a partnership. The SSBMO assumes that multiple positive utilities may be applicable to a single Agreement.

While it is conceivable that a Firm may feel, due to wider circumstances, that they are entering into a Partnership with a Stakeholder that has some negative value, the SSBMO does not conceptualize this possibility.

- Importance attribute gives the business model designer the opportunity to consider the relevence to the firm's success of a particular Agreement. As with the BMO, the higher the value the more strategic the Agreement.
- Co-opetitor attribute gives the business model designer the opportunity to consider the overall relationship between the firm and the stakeholder involved in this agreement.

  Unlike the BMO that assumes partners can only be a potential competitor (or at best 'not a competitor'), the SSBMO conceives that while some partners will be competitors at some points in time, others will be primarily be co-operators (collaborators). The possible values of this attribute range from

  - -5, Target Stakeholder in this Partnership Agreement is in all other circumstances a competitor (proactively trying to cause the firm 'death'), to
  - +5, Target Stakeholder in this Partnership Agreement is always a co-operator / collaborator (proactively trying to ensure the firms 'success').
- Integration attribute gives the business model designer the opportunity to consider the overall structural integration of the firm and the target stakeholders involved in an agreement.

  This can range from a 'simple' environmental, social or economic transaction relationship, through to the stakeholder being a fully owned subsidiary of the Firm (or vice versa)[69.]

- Co-dependency attribute gives the business model designer the opportunity to consider how mutually inter or independent the firm and the stakeholder involved in an agreement are to each others success.

  Unlike the BMO thatassumes the firm is only concerned with how un-substitutable a partner might be (and hence how 'at the mercy' the Firm is to that partner)[70], the SSBMO conceives that while there may be low switching costs (high substitutability) with some partners, with others switching could do significant mutual harm, due to widespread co-dependencies.

  This could occur, for example, in an industrial ecology arrangement with co-dependencies in both the 'acquisition of resources' and the 'disposal of wastes' with other firms. In some respects such industrial ecosystems are far more resilient, despite their high degree of co-dependency. In other respects the potential for catastrophic failure is also higher (i.e. increased fragility) (Taleb, 2012).

  The business model designer should carefully consider the relationship between the level of co-dependency in its partnerships and the overall impact on firm resilience / fragility[72].

  The possible values of this attribute range from:

  - -5, Target Stakeholder in this Partnership Agreement has no other Relationships with this firm nor Relationships with any other of the Firm's Target Stakeholders (i.e. substituting this target stakeholder with another has no immediate or long term negative value to a Firm and its other Target Stakeholders), to

  - +5, Target Stakeholder in this Partnership Agreement has a range of other Relationships with this firm and other of the Firm's Target Stakeholders that are critical to mutual success (i.e. substituting this Target Stakeholder with another

[72] This is a typical trade-off in an ecosystem, as the level of elaboration increases over time. As elaboration increases so does levels of mutual species inter-dependence. In turn this increases the potential for tipping points between dramatically different system behaviour attractors to be possible and to occur (i.e. individual species fragility may increase). The relationship between co-dependence and resilience / fragility is not straightforward to understand or to assess in any specific situation (Taleb, 2012).

has immediate and potentially catastrophic negative value to a firm and its other Target Stakeholders).

- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Partnership Agreement in a business model (as per DDP6). Location can be considered as part of the Social Context of a Partnership Agreement (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of a Partnership Agreement (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

Table 7-51 compares the BMO Agreement Reasoning attribute values to possible SSBMO Agreement Utility attribute values synthesized from the literature (Chapters 3 and 4).

BMO Reasoning Attribute Values	SSBMO Partnership Agreement Utility Attribute Values	Agreement Goal Logic
Optimization and Economies of Scale	Efficiency	The environmental, social or economic efficiency of a Firm, decreasing Costs.
	Effectiveness	The environmental, social economic effectiveness of a Firm, decreasing costs and / or increasing Revenues.
Reduction of Risk and Uncertainty	Risk Reduction	Make the delivery of a Firm Value Proposition more reliable and / or less prone to (unanticipated or undesired) failure.
Acquisition of Resources	Gain Privileged Access	Obtaining a Resource and / or the provision of an Activity (service) required to make a Firm Value Proposition possible.

Table 7-51: Comparison of Possible Partnership Utility and Reasoning Attribute Values

The terminology "gain privileged access to"[73] is introduced here but is widely applicable across many of the relationships in the SSBMO. Hence a deeper explanation is required. Further, this conception significantly changes the relationship of a firm to its resources and activities. In the profit-first conception, a firm typically believes they have a significant amount of right to determine the disposition of resources that they own (or control) and how to undertake all activities they control. Legally of course it is possible to make an agreement for ownership rights over a resource or for a service (which contributes to an activity). These provide the owner some legal rights to control the disposition of the owned item or gain benefit arising from a service. In many cases these ownership rights are shared, e.g. when one actor has a 'financial interest in' it is assumed there is some degree of ownership involved, but that this is shared with other actors[74].

More recent ecological modernist inspired ideas of 'stewardship over' start to consider other rights and responsibilities derived from ethical or moral imperatives, but these (as would be expected) are largely supplementary to the above concepts of legal / financial control and ownership.

However, in strong sustainability Biophysical Stocks and Eco-system Services are always firstly, or primarily, part of the Environmental Context. A firm's transformation of Biophysical Stocks and appropriation of Eco-system Service flows happen first and foremost in the Environmental Context. Social (legal) and Economic Contexts take necessary secondary roles.

Hence when a Firm makes a social agreement to take legal ownership over a Bio-physical Stock or Eco-system Service flow they are in reality only gaining some privileged and

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[73] Thanks to Prof. Henry Kim, Schulich School of Business, York University who suggested this terminology Dec 7, 2011.

[74] The social concept of ownership is highly complex and multifaceted. Blattberg provides a useful introduction in the context of sustainability citing theoretical works, he states that there are "eleven criteria within the 'full' concept of ownership: (1) there are rights to possession; (2) to use; (3) to management; (4) to gain income from; (5) to alienate, (6) consume, waste, or destroy; (7) to a secure sense that one will remain the owner as long as one chooses; (8) to transmit the item to one's successors after death; (9) to an unlimited term of ownership while one lives; (10) and to 'residual control' (i.e. one's rights to an item return when the period it had been leased to another ends); (11) just as there are duties not use the item in a harmful way; and to expect that one's rights to the property can be taken away for reasons of liability." (Blattberg, 2000, p.181)

temporary access to it. Such access may well infringe of other actors ability to meet their needs. Such infringements are clearly a big reason Actors become impactful Target Stakeholders of Firms and that this is often a big surprise to profit-first firm's when it happens (Conroy, 2007).

To ensure business model designers have the opportunity to recognize these implications (of a firm's situation in the Environmental Context), terms like 'control over' or 'acquisition of' resources and activities (of all kinds) is replaced with "gain privileged access to". This serves to remind the business model designer that such access is a privilege, and just because they have that privilege now does not mean that this will always be true (and may depend on how the firm and other actors respect the privilege gained).

7.4.5.5 Capability

Name	Capability
Definition	The ability to execute a repeatable pattern of actions that do work which results in an increase in entropy, i.e: ● Transform / move matter ● Produce / manipulate knowledge[75] ● Form / change opinion
Related to (including cardinality of relationship)	Capability *is constrained* by Environment (1,1) Capability *occurs within the context of* Society (1,1) and Financial Economy (1,1) Capability *occurs within the context of Firm Process Perspective* (1,1) (i.e. Capabilities are unique to a Firm) Capability *provides* Value Proposition (0,n) (Note optionality) Capability *contributes to* Value Configuration (1,1) Capability *comprises* Resources (0,1) (Note optionality)
Cardinality	1,n
Attributes	Name (Identifier) = All characters Description = All characters [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]
References	(Osterwalder, 2004a, Table 29 pp.79-80) DDP5 (Harmon, 2011; McKnight, 2012)

Table 7-52: Capability

[75] Here explicit knowledge is taken to mean information resulting of some formal credentialing, such as publication in a peer reviewed journal (although this is by no means the only credentialing process). Tacit knowledge is taken to mean information that enables a human to successfully undertake an activity. Opinion is information that is both uncredentialed and unrelated to undertaking an Activity.

The Capability entity encourages the business model designer to consider what abilities a firm needs to deploy in order to create, make and deliver its Value Propositions to its Target Stakeholders. Capabilities comprise a number of Resources to which the Firm has gained privileged access directly or via Partnerships with its Target Stakeholders.

The Capability Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Capability in a business model (as per DDP6). Location can be considered as part of the Social Context of a Capability (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of a Capability (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

7.4.5.6 Resource

Name	(Capability) Resource
Definition	All tangible and in-tangible stocks required by Value Configuration that make possible a Firm's Value Propositions. "Tangible" = All matter (collections of chemical elements, see Table 4-6). . They ● Can ***never*** be created or destroyed, only moved or transformed by a business model. ● Are ***always***, by definition, an instance of a Bio-physical Stock. "Intangible" = All non-matter
Related to (including cardinality of relationship)	Resource *is constrained by* Environment (1,1) Resource *occurs within the context of* Society (1,1) Resource *sometimes occurs within the context of* Financial Economy (0,1) Resource *occurs within the context of Firm Process Perspective* (1,1) (i.e. Resources are unique to a Firm, although they may be related to another Firm's Resource) Resources *is required by* Activity (1,n)[76] Resource *transformed into or from another* Resources (0,n, 0,n) (over time as a result of Activity) Resource *related to another* Resource (0,n, 0,n) (May be the same or a different instance of the same Biophysical Stock to which another Firm has privileged access to) Resource *used in calculation of* Process Metric (0,n) (Note optionality; *via* Valuation Method) Resource *part of* Bio-physical Stock (0,n) (For all tangible instances of Resource this relationship is mandatory. Optionality is required only because some instances of Resource are intangible)[77] Resource *accessible as a result of* Agreement (0,n) (Note optionality) Resource *part of* Capability (1,n)

[76] Osterwalder takes considerable effort to suggest that the relationship between a Resource and an Activity is one of "fitting", "flowing" or "being shared" (Osterwalder, 2004a, Fig.41 pp.82-83). These ideas remain relevant but have been summarized as Resource *is required by* Activity.
[77] Business model designers desiring to create strongly sustainable business models are required, based on the natural science (4.4 and 4.6), to respect the mandatory cardinality of this relationship.

Name	(Capability) Resource
Cardinality	1,n
Attributes	Name (Identifier) = All characters Description = All characters Category = “Tangible” | “Human” | “Intangible” (Humans are a category of tangible resources of particular importance to business models)[78] Utility = { “Energy” | “Properties” | “Virtual” } Type = “Biological Nutrient” | “Technical Nutrient” | “Virtual” (In relationship to the overall Environmental Context; All Tangible Resources must be one or other Type of Nutrient) Toxicity Impact = <Potential> | <Actual> <Impact on Eco-System Service flourishing, up to and including catastrophic damage and ceasing of all flows> | <Impact on quantity or quality of other instances of the same or another Bio-Physical Stock / Actor> | Virtual (Impact Quality includes impact on quality of health or flourishing) Degree of Access = “Direct” | “Indirect” | “Implicit” Quantity = <number> <units> Transformation Sequence = <number> Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> “,” <Longitude> “,” <Elevation> } > (Optional for Resources of Category Intangible)
References	(Osterwalder, 2004a, Table 31 pp.81-83) DDP5 DDP6 (Eriksson & Robèrt, 1991; Fadel, 1994; McDonough & Braungart, 2002; Stahel, 1994)

Table 7-53: (Capability) Resource

[78] “Tanglible” | “Intangible” | “Human” are the possible values of the Type attribute of the Capability Resource element of the BMO (Explained at some length in Osterwalder, 2004a, p.81). The label “Category” is used for this attribute in the SSBMO.

The Resource entity encourages the business model designer to consider:

- What resources (bio-physical, human, social, knowledge, monetary, energy) are required to create, deliver and maintain your value propositions?
- How do these resources contribute to the capabilities required to make the value propositions possible?

The BMO only conceptualizes resources as that which may be:

- Obtained for a monetary cost that enables a net monetary profit. Due to the weak conceptualization of Actor (7.4.3.2) it is easy to omit resources provided by certain types of stakeholders, such a tacit knowledge or effort provided by employees.
- Directly produced by the focal firm that may have a monetary value (i.e. a finished good that has potential revenue value, or a waste stream that has potential cost value).

The SSBMO broadens this idea in two ways that have a considerable number of implications, discussed below. The SSBMO conceptualizes that:

1. The ultimate environmental and social contexts of all firms requires the explicit and thorough consideration of the ultimate source and sink of all stocks a firm has privileged access to – tangible (bio-physical) or intangible.

   These include those resources the firm takes legal ownership over, to those that the firm merely controls during the execution of its processes (e.g. atmospheric oxygen transformed in processes requiring combustion).

2. Tangible resources may not be created or destroyed by any Firm's processes. Rather resources may only be moved or transformed. For tangible resources transformation includes mechanical, nuclear, chemical or biological processes such as: assembly, irradiation, adhering/coating, reaction (combustion, etc.) or growth.

   Remembering the laws of conservation of matter and energy and despite conventional language, such as 'using up a fuel', it is more useful to consider the transformation of the fuel and the oxygen into a number of other resources (i.e. chemical products of combustion, such as carbon dioxide and energy).

The nature of the movements and / or transformations of resources required for the realization of the value propositions are described in the related Activities.

A key requirement to model this conception is that Resources may be related to other Resources as a result of transformation processes. This enables ideas such as raw materials being processed to create finished goods to be modelled with as much or little granularity as is deemed useful. In this example the raw materials, any work-in-process inventory, packaging materials and the packaged finished goods are separate but appropriately related instances of Resources.

Further this relationship between instances of Resource may be used to model multiple Firm's privileged access to a single instance of a Resource. This allows for two key concepts to be modelled:

1. A 'finished good' Resource instance of a Bio-physical Stock, such as an ingot of metal, may be related to the same instances of the Bio-physical Stocks as it becomes a 'raw material' for another firm via a sale / purchase Partnership Agreement executed through applicable sales and distribution Channels enabling value creation for both stakeholders. Through this conception full lifecycles of bio-physical stocks may be modelled from 'cradle-to-cradle' (or grave).
2. A 'fixed asset' may be shared by multiple firms, and take part in multiple firm's Activities, based on a sharing Partnership Agreement, e.g. the sharing of a transport truck between a number of small food processes who all sell at the same farmers markets.

Together these conceptions encourage the business model designer to consider the (biophysical) realities, along with the social and ethical rights and responsibilities that come with 'privileged access' to resources.

The Resource:

- Category attribute gives the business model designer the opportunity to consider the underlying nature of the resource, and hence the realities, rights and responsibilities which much be considered.

  This attribute has the same possible values as in the BMO.

- Utility attribute gives the business model designer the opportunity to consider the reasons a Resource plays an important role in enabling the value propositions efficiently and effectively, environmentally, socially and monetarily. This gives an opportunity to consider the nature of alternatives which may have a better contribution to environmental, social and monetary flourishing.

- Type attribute gives the business model designer the opportunity to consider the preferred relationship of the resource with the Environmental Context based on its type.

  Unlike the BMO, which is not concerned about the relationship between the resources a business model requires and their ultimate social and environmental contexts, the SSBMO conceives of resource type as a critical determinant of the acceptable Activities that may be performed on that resource.

- Toxicity Impact attribute gives the business model designer the opportunity to consider the potential or actual effect of each resource required by a business model on all Actors (human and non-human, legitimated as stakeholders or not) in the broader environmental, social and monetary contexts.

- Degree of Access attribute gives the business model designer the opportunity to consider the nature of the privileged access to a resource, and hence the associated rights and responsibilities.

- Quantity attribute gives the business model designer the opportunity to consider the amount of a resource to which a firm has privileged access. For Tangible Resources business model designers may wish to consider this quantity in light of the Location and Total Quality of the related Bio-physical Stock.

- Transformation Sequence attribute gives a business model designer a mechanism to record how one instance of a Resource relates to others as it is transformed during the associated Activities.
- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for the Resources required for a business model (as per DDP6). Location can be considered as part of the Social Context of a Resource (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of a Resource (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

  Location is only an optional attribute for Resources of Category Intangible.

Tangible resources are both critical to all business models and highly complex in the environmental, social and monetary implications of their use to enable value propositions. It is important for business model designers to explore this complexity and determine, based on the acceptable definition of success for the focal firm, which resources to use and how they will be transformed by the activities.

Tangible resources include all bio-physical stocks required to enable the value propositions. Hence they include all living matter (Table 4-6) [79]. Only Eco-System Services can create new Bio-Physical Stocks to which a firm can gain privileged access to (Table 4-5)! e.g. Primary and Secondary production are the eco-system service that produces all plant and animal life (including more human resources).

Hence, the quantity of Tangible Resources is ultimately limited by the quantity of the related Bio-physical Stock. Further, Bio-physical Stocks required by Eco-system Services should

[79] Although humans are undoubted biophysical, due to their importance to business models they have been categorized apart from other tangible resources. Note that all instances of all Actors have a mandatory relationship with a Bio-physical Stock. However, not all Bio-physical Stocks are necessarily Actors.

not be moved or transformed, but may be used if the Activity enables the eco-system service to continue to flourish, with the flow of service remaining undiminished in quantity or quality.

Considering the importance to business models of 'human resources' this sub-type of Tangible Resource is categorized separately for clarity. This allows the conceptualization of physical or mental human effort as a necessary resource.

Tangible stocks must be tracked in their primary context, the bio-physical environment, for their full-life cycle. This is because instances of bio-physical stocks cannot be created or destroyed; but only ***transformed*** by a firm's business processes. Hence a firm needs to understand the disposition of all instances of all biophysical stocks to which they have 'privileged access': before, during and after transformations and / or movement. Both the material and time boundaries of this understanding should be carefully considered.

The material and time boundary of the tracking of bio-physical resources should ideally start and end with a materials entering or leaving the social and economic context from a purely environmental context, such that "System Conditions" 1, 2 and 3 are maintained (4.4.3.2 Sustainability). An example of such a contextual transition is a mineral in the lithosphere (a purely environmental context) which is then subject to a mining claim (a social and economic context)[80].

Such a transition is modelled in the SSBMO by considering when any stakeholder in a business model first gains privileged access to, and hence responsibility for, any instance of a Bio-physical Stock required by a business model. This event is the trigger for creating an

[80] One could argue that all parts of the biosphere are now in the social context – stocks and service flows. This is due to the Western philosophical approach that legally associates each and every piece of the Earth's area (the environmental context) with a nation state (a social context); even the concept of 'international waters' is a social conception with associated legal rights and duties. Hence at some level all Bio-Physical Stocks are Resources in at least one business model. This is aligned with the idea that in the anthroprocene era humanity has, like it or not, become the defacto albeit perhaps highly flawed manager of the entire biosphere (Allen, 2003). While clearly the biosphere still imposes ultimate limits on society, in this perspective society and the biosphere now have the same extent. Attempting to be good managers of the biosphere suggests humanity needs to know the location and quantity all stocks at all times (i.e. to track bio-physical stocks and eco-system services). The macro-ecological economic policy recommendations (aka management strategies) to achieve flourishing within a finite world imply such tracking is also required for these policy objectives to be achieved (4.6.4).

instance of the stock in the Resource entity associated with the firm that first gains the privileged access.

Each Resource bio-physical stock instance only leaves a business model (i.e. the instance is deleted) when it no longer has a social context. This is a necessarily rare event. Many (more) Bio-Physical Stocks permanently become Resources to business models than will cease to have any social context. One of the few pathways is via biological assimilation (e.g. biological decomposition), but even this is only a transformation, and the transformed matter will still have to be placed somewhere in the biosphere. Then, in many cases a social or economic actor will demand something in return (e.g. a trucking company asking for payment to move a city's decomposed organic waste to farms). Alternatively the location where the material will be placed may be owned by a human actor, and hence that actor still has privileged access to the decomposed matter (e.g. the farmer owns the land on which the decomposed matter is placed).

The above defines the required boundary for the responsibility towards that stock (and any form's into which it is transformed or any spatial or geographic locations to which it is moved) by any stakeholder in the business model. This is a complete conceptualization of responsibility of all the individual and collective actors in a business model towards all the tangible resources involved.

Note that tracking a resource in relationship to the social and economic contexts may also be of importance to Firm success, but they are not primary. Many existing mechanisms exist for such purposes. For example: 'chain of custody' systems in forestry (Forestry Stewardship Council) and certain areas of food production; shipping tracking systems; all inventory and warehouse management systems, etc.

Intangible resources include all non-matter, e.g. knowledge (explicit and tacit), opinion, relationships, and monetary units. It is also suggested that a business model designer tracks intangible resources through as many antecedents and successors as possible (at least in a business model design, hence the inclusion of the Relationship and Measurement Perspective entities in the SSBMO to do this). Given the complex relationships between the virtual and tangible such tracking should help a business model designer understand current and minimize future unintended consequences[81].

Resource Instance Example	Category	Type
All tangible fixed assets: machinery, equipment, spare parts, buildings	Tangible	Biological or Technical Nutrient[82]
All raw materials, 'consumables', feed-stocks, work-in-process, ***and*** finished goods inventories, etc.	Tangible	Biological or Technical Nutrient
All waste streams – production waste, including resources with higher than ambient levels of energy (combustion gases, process steam, hot or compressed air, etc.), post-use (packaging, finished goods), etc.	Tangible	Biological or Technical Nutrient
All forms of energy whether virtual (solar electricity) or the tangible resource in which the energy is stored (i.e. chemical energy stores: petroleum, natural gas; gravitation energy stores: water in a reservoir, nuclear: fissionable materials, thermal: steam, etc.)	Tangible or Intangible	Biological or Technical Nutrient or Virtual
All humans who are required to exert physical or mental effort as part of a process – i.e. all Target Stakeholders whose effort is accessible as a result of a Partnership Agreement (effort available from Target Stakeholders without a Formal Agreement is handled by the "Target Stakeholder *participates in* Activity" relationship, 7.4.3.4, 7.4.5.9)	Human	Biological Nutrient[83]
All intangible assets: brand (a monetarily valued form of social capital), etc.	Intangible	Virtual
All stocks of financial capital: working capital, cash, loans, etc.	Intangible	Virtual
Intellectual property (a monetarily valued form of intellectual capital)	Intangible	Virtual
All tacit and explicit knowledge	Intangible	Virtual
All environmental, social or financial Relationship Equity created by a Firm's Relationships required for Value Proposition creation and delivery.	Tangible or Intangible	Biological or Technical Nutrient or Virtual

Table 7-54: Possible Capability Resource Instances

[81] A business model designer might best develop such an understanding using the iterative function, structure, process, context exploration process suggested by Gharajedaghi (3.5.4.3).
[82] The determination of which Type results from how resources, for example, that are instances of manufactured capital, are designed and created! Hence there are choices to be made when selecting the Resources that impact the sustainability of the resulting business model.
[83] Perhaps surprising, but true; modelled via optional relationship of all Bio-physical Stocks to Actors. Of course artificial parts of human bodies, the result of medical interventions (fillings, orthopaedic joints, pins, drugs etc.) mean that, at least for the cremation industry, human bodies must be treated as a combination of biological and technological nutrient!

Table 7-54 provides a partial list of possible resources that a business model designer may wish consider, synthesized from the literature (Chapter 3 and 4). This list was partially developed by considering which resources are a part of each type of capital: natural, manufactured, human, intellectual, social, and financial. Possible values of the Resource Category and Type attributes are provided for each.

The Utility attribute provides the business model designer with a mechanism to sort through the considerable complexity related to resources by explicitly considering why each particular resource is useful in enabling the value propositions, and hence whether more environmental, social or monetarily contributory resources may be substituted. Table 7-55 describes possible values of the Utility attribute synthesized from the literature (Chapters 3 and 4).

Capability Resource Utility Attribute Value	**Description**	**Example**
Energy	The resource is or stores energy	Solar energy, electricity, any hydro-carbon fuel, etc.
Properties	Some bio-chemical-physical or non-material property	Elasticity of rubber; intelligence, knowledge, strength and/or dexterousness of a human; strength/weight ratio of a metal, energy efficiency of a machine, etc.
Virtual	the resource is intangible	Electricity, tacit or explicit knowledge, opinion, etc.

Table 7-55: Possible Capability Resource Utility Attribute Values

The definition of the material and time boundary for the creation of instances of the Resource entity (see above) enables the modelling of the required total separation of the two types of nutrients:

1. "biological nutrients" (within the environmental-social-economic metabolism)
2. "technological nutrients" (within a related but entirely materially isolated and human created, and hence socio-economic metabolism).

Such separation is asserted to be required for true "cradle-to-cradle" business models (McDonough & Braungart, 2002, pp.103-113). Hence the SSBMO may describe organizations that are in full compliance with "System Conditions 1, 2, and 3" (4.4.3.2 Sustainability).

Table 7-56 uses McDonough and Braungart's basic definitions of the types of resources that a business model designer should consider in order for their business model to hold with System Conditions 1 and 2 (4.4.3.2 Sustainability).

The Resource Type, for practical reasons based on current social norms, is likely to be aspirational in many current contexts; very few, perhaps no truly closed technical nutrient metabolisms current exist. Hence many tangible resources deemed 'necessary' to many current business models will continue to hinder environmental and social flourishing.

Even in the future, when technical metabolisms are well established for large numbers of technical nutrients accidents may happen that can seriously harm eco-system flourishing.

For both these reasons it is important for the business model designer to consider how harmful or potentially harmful each resource is in the environmental and social context. In other words, how environmentally and socially risky is the use of a given resource[84]. Again this provides the opportunity to consider using, specifying or creating less risky alternative resources.

[84] Of course such damage could end up in the financial economic context via a legal claim for damages, or costs for 'clean-up' and 'remediation', etc.

Capability Resource Type Attribute Value	Description	Example
Biological Nutrient	Resource is ultimately bio-degradable, doing so while ***contributing*** to eco-system flourishing	Plants and animals grown without the aid of technical nutrients and in an environment where no technical nutrients are present
Technical Nutrient	Potentially harmful to eco-system flourishing once it is separated from its original location in the lithosphere or if re-introduced into the biosphere	Most chemical elements and chemical compounds (except perhaps those that follow the principles of 'green chemistry': Anastas, 1998), most manufactured goods (except perhaps those designed using cradle-to-cradle principles: McDonough & Braungart, 2002, Table 4-14)
Virtual	The resource is intangible	Solar energy, electricity, tacit or explicit knowledge, opinion, etc.

Table 7-56: Possible Capability Resource Type Attribute Values

There are clearly a huge number of potential impacts of a business model's resources on any and all parts of the environmental and social contexts. Indeed it is well known that the toxicity of most chemical compounds is unknown and (very) under-researched. This is a clear area for the consistent application of the "pre-cautionary principle" in order to attempt to meet "System Condition 2" (4.4.3.2 Sustainability).

Toxicity, i.e. degree and scope of harm to a living organism, may be thought of as being as a result of the interaction between life and the resources':

- Concentration (i.e. nearly everything is toxic to life in sufficient concentrated form, or given a sufficient period during which it interacts with an organism).

- Proximity to other resources (i.e. a resource may not be toxic in one location, but highly toxic in another, e.g. the sulphur compounds near a hot spring will support life there but harm life if moved elsewhere).
- Physical properties (e.g. coal dust, asbestos).
- Chemical properties (e.g. lead, chlorine gas, organic compounds such as alcohols, most pharmaceuticals, and poisons).
- Biological properties (e.g. bacteria, viruses).

Synthesizing the literature (Chapters 3 and 4), Table 7-57 suggests three classes of Toxicity Impact are of importance to business model designers.

Capability Resource Toxicity Impact Attribute Value	**Description**	**Example**
Impact on Eco-System Service flourishing	Actual or potential for this Resource to harm Eco-system Flourishing	Actual: dentists use of mercury. Disposing of this in sanitary sewers leads to bio-accumulation in (particularly) Northern eco-systems and the flows from those services harming all proximate life, including human babies (Hylander & Goodsite, 2006). Potential: unplanned release of most products of most chemical plants. Potentially catastrophic impact on nearby wetlands ability to regulate and purify water.
Impact on quantity or quality of other instances of the same or another Bio-Physical Stock / Actor	Actual or potential for this Resource to reduce number or quality of the same or another Resource	Actual: Production of compounds of chlorine (e.g. most vinyl) harms human workers. Potential: If the PH value is the Property of Resource Utility, any acid or base if mixed with the other will tend to neutralize both.
Virtual Impact	The toxicity is intangible	Mental toxicity to a human as a result of using a specific mental resource in a particular manner and/or context. e.g. Using the resource of highly skilled public transit operators can be highly stressful leading (ultimately) to physical symptoms.

Table 7-57: Possible Capability Resource Toxicity Impact Attribute Values

Business model designers aiming for strongly sustainable business models will need to think very carefully about where the boundaries of responsibility for tangible Resources lie (Stahel, 1994). In a finite world there is no ultimate 'away' – everything exists, and is a potential contributor to unintended consequences at any point in future time. Hence, as per Doppelt's "Natural Laws of Sustainability" (Doppelt, 2012), once privileged access to a bio-physical stock has been established, the moral or ethical requirement for ensuring stewardship of that stock by the actor that first gained that access and the associated duty of care continues ***forever***[85]. This is the basis for the idea of closed "technical nutrient cycles" and several of the System Conditions for a Sustainable Society (4.4.3.2 Sustainability and McDonough & Braungart, 2002, pp.109-113).

The Degree of Access attribute allows the nature of a firm's privileged access to a resource to be described. Table 7-58 synthesizes from the literature possible values for the Degree of Access attribute that a business model designer may wish to consider in light of the "Natural Laws of Sustainability" and Resource Type (Chapters 3 and 4).

Capability Resource Degree of Access Attribute Value	Description of Nature of 'Privileged Access'	Example
Direct	Via an explicit term or condition codified in Partnership Agreement with a Target Stakeholder	Resources purchased
Indirect	Via a social norm arising from a Partnership Agreement	Flexibility in employees (unexpected over-time, duties, during 'emergencies' etc.)
Implicit	via a social norm, including those legally codified	Right to transform atmospheric oxygen into carbon dioxide during combustion of hydro-carbons

Table 7-58: Possible Capability Resource Degree of Access Attribute Values

[85] In the same sense meant by Ehrenfeld in his definition of sustainability (4.4.3.2 Summary).

Continuing the earlier example of a city's decomposed biological waste being moved to a farm: perhaps if the farmer has an appropriate certification for soil care, this disposition of decomposed matter might be considered an 'edge' of a business model. But even then, problems arise, since the decomposed matter will likely include considerable quantities of technological nutrients that will bio-accumulate in the crops (and hence animals) that grow on that land, e.g. 'stickers on fruit', pesticides from non-organically grown food, etc. If this occurs systematically, as is certain in current instances of this process, then the "technical nutrient metabolism" would be far from closed (McDonough & Braungart, 2002, pp.109-113) and "System Condition 2" (4.4.3.2 Sustainability) would be violated. This implies that today such a business model would not lead to a sustainable biosphere and hence society; thus considerable work is required even to start to close the technical nutrient metabolism (Eriksson & Robèrt, 1991).

Closing Thoughts on Capability Resources

What might ameliorate all the above increase in cognitive and practical complexity over a profit-first business model conception of resource? Perhaps it is the idea that one or more Actors (and the related Target Stakeholders) may find value in the required 'cradle-to-cradle' tracking of all the tangible resources to which the Actor's in the business model have privileged access. This could be because such tracking enables benefits for those actors related to achieving the system conditions, and hence human flourishing. Such value propositions can be captured and their benefits described using the appropriate entities and relationships in the SSBMO. By not being able to conceptualize such ideas, profit first business models may expose their designers to unintended risk.

Recognizing many of the current social, legal and economic difficulties in operationalizing such tracking, McDonough and Braungart and the Framework for Strategic Sustainable Development (4.6.5.6) offer a number of suggestions for the resource related aspects of a business model. These patterns create significantly less harm that existing linear 'take-make-waste' approaches and offer firms the opportunity to develop business models that "move in the right direction", provide a "flexible platform" while providing "an adequate return on investment to seed future investments" (Holmberg & Robèrt, 2000). These approaches include:

- Using only matter consisting of chemical compounds that may be decomposed by non-human biochemical processes that result in concentrations of compounds in the biosphere that are no higher than existed prior to the industrial revolution (i.e. using biological nutrients)
- Reduce to a minimum the use of technical nutrients. Where these cannot be eliminated re-use or recycle without leakage into the wider biophysical environment. Ideally this means approaches that allow a nutrient to be 'up-cycled' or 're-cycled' *forever* and never 'down-cycled'.
- Taking out insurance for potential future expected or unforeseen[86] damage, i.e. paying in advance for the 'right to pollute', or 'off-setting' such damage with an equivalent amount of contributory activity (7.4.3.2).

Together these approaches offer paths to move from our current unsustainable approaches to bio-physical resource management, through a 'less unsustainable' stage, to a completely cyclical approach.

[86] i.e. beyond what the application of the 'Precautionary Principle' using current scientific knowledge can anticipate.

7.4.5.7 Bio-Physical Stock

Name	Bio-Physical Stock
Definition	The total quantity of each type of living and non-living matter within the biosphere.
Related to (including cardinality of relationship)	Bio-Physical Stock *is one part of* Environment (1,1) (Note there is no social or economic context for instances of this entity; this is a definitional attribute of Bio-Physical Stock) Bio-Physical Stock *occurs within the context of Process Perspective* (1,1) Bio-Physical Stock *includes all* Resource (1,n) (of Resource Category Tangible) Bio-Physical Stock *flows through and / or is transformed by* Eco-System Service (1,n) Bio-Physical Stock *is a* Actor (0,1) (Note optionality)
Cardinality	1,n
Attributes	Name (Identifier) = All characters Description = All characters Total Quantity = <number> <units> Quality = <Concentration at a given Location> <units> Location = <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >
References	DDP3 (Table 4-6) DDP6 (Hanson, Ranganathan, Iceland, & Finisdore, 2008; Hanson, Ranganathan, Iceland, & Finisdore, 2012)

Table 7-59: Bio-Physical Stock

The Bio-Physical Stock entity provides a space for business model designers to consider from where do all materials required by a business model come from, and where do all the outputs from a business model eventually end up.

The Bio-Physical Stock entity encourages the business model designer to consider:

- Which bio-physical materials are transformed during the processes which create, deliver and maintain your value propositions?
- How much of these stocks exist?
- How quickly are stocks replenished, if at all, by related Eco-System Service flows?[87]
- Where are these stocks located at all times and in all forms?
- How these stocks relate to the Eco-System Services that your stakeholders value?

Answering these questions can lead to true cradle-to-cradle thinking since no materials on this planet are ever created or destroyed – only moved from place to place or transformed from one bio-physical stock into another[88]. A strongly sustainable business model will consider all the inputs to and outputs from all the transformations (intentional and unintended) required for the organization to deliver its value propositions.

Coding the Bio-Physical Stock entity outside of the Social and Financial Economic Context Generalization entities enables the SSBMO to model the practical reality that all Bio-Physical Stocks on our finite planet are theoretically shareable by all Actors, whether or not they are Target Stakeholder's of the focal firm or other organizations in a particular business model! Questions of equity, and the role of firms enhancing or reducing Actors perceived equitable access to bio-physical stocks, quickly come into play. Such questions are made more complex because of the current economic and social 'realities', and bio-physical limits, that prevent sharing. As one common, but often unacknowledged physical limitation, is the fundamentally heterogeneous distribution of bio-physical stocks on the planet and energy availability (let alone monetary cost) to move a stock to where it is perceived as needed. For example many ores, minerals, gems, hydro-carbons are not evenly distributed in the lithosphere.

[87] Within 'medium scale' human timeframes (4.4.3.2)

[88] True for (all) processes relevant to human organizations on planet Earth, except perhaps those launching artefacts outside the exosphere.

However, such challenges do not alter the reality that all life requires a certain minimum quantity and quality of bio-physical stocks within specific time periods in order to avoid death, and increasing quantities to survive, languish or flourish.

Further, all Actors are Bio-Physical Stocks (including humans, created as is all animal life by the Secondary Production Eco-System Service!). However, not all Bio-Physical Stocks are Actors in a given business model.

Table 4-6 provides a complete list of Bio-Physical Stocks, and using Table 4-5 a business model designer can derive a list relevant to a specific business model[89].

The Bio-Physical Stock

- Total Quantity and Quality attributes gives the business model designer the opportunity to consider the quantity, quality and units of quantification of each Bio-Physical stock available at each relevant Location.
- Location attribute gives the business model designer the opportunity to consider the place of each Bio-Physical Stock (as per DDP6). Location is a constraint imposed by the Environmental Context of a Bio-Physical Stock (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

[89] An example of a list of biophysical stocks is presented in an instance of the SSBMO produced as part of its evaluation (See SM6).

7.4.5.8 Value Configuration

Name	Value Configuration
Definition	Arrangement of Activities and Capabilities that makes possible Value Propositions
Related to (including cardinality of relationship)	Value Configuration *is constrained* by Environment (1,1) Value Configuration *occurs within the context of* Society (1,1) and Financial Economy (1,1) Value Configuration *occurs within the context of Firm Process Perspective* (1,1) (i.e. Value Configurations are unique to a Firm) Value Configuration *makes possible* Value Proposition (1,n) Value Configuration *comprised of* Activity (1,n) Value Configuration *relies on* Capability (1,n) Value Configuration *depends on* Partnership (0,n) (Note optionality) Value Configuration *results in* Decision (0,n) (Note optionality)
Cardinality	1,n
Attributes	Name (Identifier) = All characters Description = All characters Type = "Product" | "Service" [90] [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]
References	(Osterwalder, 2004a, Table 32 pp.83-84) DDP5

Table 7-60: Value Configuration

[90] "Value Chain" | "Value Shop" | "Value Network" are the possible values of the Type attribute of the Value Configuration element of the BMO (Explained at some length in Osterwalder, 2004a, p.84). Osterwalder takes considerable effort to justify these three values, making a fine distinction between two types of service (Value Shop and Network). In practice, the more typical product / service distinction appears more useful and descriptive.

A Value Configuration entity encourages the business model designer to consider what is required to make each Value Proposition possible:

- What combinations of Activities and Capabilities are required to create, maintain and deliver each Value Proposition?

Value Configurations comprise a number of Activities that require Resources (Tangible, Human or Intangible). In other words, Value Configurations describe the arrangement of Activities and Capabilities that are “real-value adding (RVA)” (Tenner & DeToro, 1997, pp.110-111), i.e. an activity that directly contributes to meeting a Target Stakeholder Actor Need (Table 7-62).

Value Configurations may fundamentally depend on one or more Partnerships, i.e. a while there may be Agreements concerning Activities and / or Resources required for each Value Configuration, some aspects of the configuration of the Activities and / or Resources may also be the subject of a Partnership’s terms and conditions.

The Value Configuration

- Type attribute gives the business model designer the opportunity to consider the primary characteristic of each Value Configuration: is it based on the concept of providing a tangible product requiring effort on the part of the customer stakeholder to gain its value, or an intangible services enabling the customer stakeholder to reduce their effort while still gaining value.

- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Value Configuration in a business model (as per DDP6). Location can be considered as part of the Social Context of a Value Configuration (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of a Value Configuration (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

7.4.5.9 Activity

Name	(Value Configuration) Activity
Definition	Work required to make Value Proposition Offerings possible.
Related to **(including cardinality of relationship)**	Activity *is constrained by* Environment (1,1) Activity *sometimes occurs within the context of* Society (0,1) and/or Financial Economy (0,1) Activity *occurs within the context of* Firm Process Perspective (1,1) (i.e. Acitvities are unique to a Firm) Activity *involves* Target Stakeholder (0,n) (Note optionality) Activity *makes possible* Offering (1,1) Activity *is a part of* and / or *connected to another* Activity (0,n; 0,n) (Note optionality) Activity *measured by* Process Metric (0,n) (Note optionality) Activity *requires flow from* Eco-System Services (1,n) (or *benefits from*, *causes [irrevocable] harm to*, *contributes to flourishing of*, etc.) Activity *executed as a result of* Agreement (0,n) (Note optionality) Activity *involves* Resource (1,n)
Cardinality	1,n
Attributes	Name (Identifier) = All characters Description = All characters Category = “Run the Business” | “Change the Business” [91] Scale = “Practice” | “Task” | “Sub-Process” | “Top Level Process” | “Business Network” Type = “Core” | “Enabling” | “Infrastructure” | “Governing” [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> “,” <Longitude> “,” <Elevation> } >]

[91] “Primary Activity” | “Support Activity” are the possible values of the Activity Level attribute of the Value Configuration Activity element that may be inherited by the Value Configuration element from the Activity element of the BMO (explained at some length in Osterwalder, 2004a, p.85). The concepts related to this attribute are split in the SSBMO. One concept is labelled “category”, i.e. whether an activity concerns the delivery of a current value proposition (“Run the Business”) or creating / changing those value propositions, delivering value propositions concerned with firm longevity (“Change the Business”) (Hoverstadt, 2008). The

Name	(Value Configuration) Activity
References	(Osterwalder, 2004a, Table 21 pp.50-56) DDP5 DDP6 (An & Jeng, 2005; Bamford & Forrester, 2010; Bandara, Harmon, & Rosemann, 2010; Baratta, 2011; Bodine & Hilty, 2009; J. S. Brown, 2000; Bruin, 2009; Chase et al., 2011; Davenport & Short, 1990; Deming, 1986; Dietz, 2006; Gharajedaghi, 2011; Goldratt, 1986; Goldratt, 1997; Hammer, 1996; Hammer, 1998b; Hammer, 1998a; Hammer & Stanton, 1999; Hammer, 2007; Harmon, 2003; Harrington, 1991; Harrington, 1997; Hoverstadt, 2008; Hyer & Wemmerlöv, 2002; Jablonski & Meerkamm, 2010; Jackson, 2000; Laguna, 2004; Lissack & Roos, 2000; Malone, Crowston, Lee, & Pentland, 1999; Malone, Crowston, & Herman, 2003; Moore, 2002; Ostroff, 1999; Ould, Venice Consulting Ltd, & British Computer Society, 2005; Rosemann & Bruin, 2005; Rummler & Brache, 1995; Sarker, Sarker, & Sidorova, 2006; Scheer & Habermann, 2000; Scholz-Reiter & Stickel, 1996; Senge, 1990; Sethi & King, 1998; H. Smith & Fingar, 2003; H. Smith & Fingar, 2004; Sterman et al., 2000; Sterman, 2000; Tapscott, 2000; Tenner & DeToro, 1997; Tenner & DeToro, 1997; Trist, 1981a; Upward, 2002; Upward, 2009; Upward, 2010b; Upward, 2010c)

Table 7-61: (Value Configuration) Activity

The Activity entity encourages the business model designer to consider the work that needs to be undertaken to create, maintain, improve and deliver each and every value proposition:

- What activities are required to create, deliver and maintain your value propositions? i.e. What are your business processes?
- Are these activities bio-physical, social, monetary, or a combination?

To perform the work involved in an activity requires the involvement of Resources. No work can be undertaken without at least one Resource with Energy Utility. Human mental or physical effort, along with hydro-carbon fuels are examples of Resources with Energy

other concept is labelled "type", i.e. the main function of an activity (i.e. a "process variant", as defined by Hammer, 1998a, Slide 3-7).

Utility. The ability of the energy that does the work of an activity to do further similar work is always reduced, i.e. Entropy is always increased by the work of all Activities.

Most of the energy to undertake Activities is provided by the Resources as a result of a formal Partnership Agreement (e.g. purchase order, sales order, employment contract etc., 7.4.5.3). However, human effort to execute an Activity may (also) come from the involvement of Target Stakeholders without a formal Partnership Agreement. For example a customer target stakeholder walking into a retail store and participating in a purchasing activity; or a supplier stakeholder searching for information about the focal firm as part of a marketing activity.

In contrast to Value Configurations that describe "Real-Value Adding" work, Activities may include a number of types of work. Table 7-62, provides a common taxonomy of types of work. Analysing the type of the work of an activity can help business model designers improve the outcomes, effectiveness and efficiencies of that work.

Work Type	Description
Real-Value Adding (RVA)	Work that transforms Resources into outputs that are necessary to deliver Value Proposition Offerings to Target Stakeholder Actors
Business-Value Adding (BVA)	A sub-type of RVA: Work deemed necessary to support, control, improve, change and monitor all other activities. BVA activities are necessary to deliver Value Propositions to Target Stakeholder's whose Actor's Needs include: longevity of the firm, transparency, etc.
Non-Value Adding (NVA)	An activity of no value to any Target Stakeholder. Relevant for describing existing, rather than desired, business models.

Table 7-62: Taxonomy of Value Adding Characteristics of Value Configuration Activity Instances

(Adapted from Tenner & DeToro, 1997, pp.110-111)

Activities may or may not have any combination of social or economic context. Examples of activities involving a social context, but without a direct economic one are volunteering and learning.

However, Activities must always have an environmental context. Many activities will only have an environmental context. Table 7-63 provides some examples.

Type	**Example of Purely Environmental Activity that Moves or Transforms a Resource**
Physical	Heat, Beat, Irradiate, etc.
Chemical	Treat, React, Combust, etc.
Biological	Birth, Growth, Live, Die or Die, Survive, Languish, Flourish, etc.

Table 7-63: Possible Value Configuration Activity Instances with only an Environmental Context

The practical reality that ***all*** activities ***must*** have bio-physical implications[92] creates the mandatory relationship between Activities and Eco-System Services modelled by the SSBMO. The relationship serves to remind the business model designer to consider whether:

- An Activity's outcome requires (or depends on) a flow of benefits from one or more Eco-System Services. For example, ultimately the ability for current life to continue to survive while undertaking combustion activities using atmospheric oxygen is based on the flow of benefits from Primary Production (photosynthesis, creating a flow of oxygen from carbon dioxide and solar energy), and Maintenance of Air Quality (which removes some toxic products of combustion) (Table 4-5). Of course current understanding of this relationship is weak, leading to increased levels of atmospheric carbon dioxide and the resultant ever increasing climate wierding.
- The flows of energy and transformed Resources resulting from an Activity:
    - Causes (irrevocable) harm to one or more Eco-System Services: their ability to continue to produce the same quantity and quality of flows of benefits. For example, 'waste' heat or chemicals being released into the environment can have

[92] Fundamentally this results from the creation of entropy as a result of the work done in an activity; hence all activities are necessarily physical process, which therefore unavoidably and necessarily creates interactions between the activity and its environmental context.

a catastrophic impact on the flourishing of many eco-system services. Examples of the impact of waste:

- Heat on Primary and Secondary Eco-System Service flourishing includes the heat 'dumped' into rivers and streams by most electricity power generation facilities. This causes significant reductions in the productivity of the eco-system services in those locations.

- Chemicals on Primary and Secondary Eco-System Service flourishing include the run-off of 'excess' fertilizers from farms into water courses and the resultant over stimulation followed by collapse of down-stream Primary Production and the consequent impact on Secondary Production.

– Contributes to the flourishing of one or more Eco-System Services: enabling them to produce historically normal quantity and quality of benefit flows. For example, organic 'waste' being released in appropriate volumes and concentrations can improve the functioning of Primary Production and hence Secondary Production Eco-System Services (Table 4-5).

The Activity:

- Category attribute gives the business model designer the opportunity to consider whether each activity makes possible the delivery of a current value proposition ("Run the Business") or the creation or changing of those value propositions ("Change the Business")[91.]

  Unlike the BMO, which only conceives of activities related to existing value propositions and divides these between activities directly related to the customer ("primary") and all others ("support"), the SSBMO enables the modelling of activity related to both current and future value propositions.

- Scale attribute gives the business model design the opportunity to consider what level of detail and scope of describing each activity is relevant, based on the purpose and audience of the business model.

- Type attribute gives the business model designer the opportunity to consider the primary purpose of the work in relation to making a value proposition possible.

  Unlike the BMO, which only conceives of the purpose of activities as either directly related to creating customer value ("primary") and all others ("support"), the SSBMO enables the modelling of a more complete view of Activity purpose.

- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Activity in a business model (as per DDP6). Location can be considered as part of the Social Context of an Activity (i.e. relative to the location of other human actors or a socially defined area, such as a country) or a constraint imposed by the Environmental Context of an Activity (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

Based on his three Value Configuration Types Osterwalder suggests that all activities have one of the following "activity natures" (Osterwalder, 2004a, Table 33 Figs.43-45 pp.85-87):

- For Value Chain: Inbound Logistics, Operations, Outbound Logistics, Marketing and Sales, Service
- For Value Shop: Problem Finding and Acquisition, Problem Solving, Choice Execution, Control and Evaluation
- For Value Network: Network Promotion and Contract Management, Service Provisioning, Network Infrastructure Operation.

Unlike the BMO, which based on these "activity natures" conceptualizes all activities at a similar scope and scale, the SSBMO conceptualizes that it may be helpful to model activities at a range of scopes and scales. The context and intended use of the business model then helps a business model designer to determine the relevant level of detail.

Based on the synthesis of a large range of business process analysis and design literature (see references in Table 7-61[93]), Figure 7-11 suggests and defines a taxonomy of Activity Scales that it is recommended the business model designer consider to help identify which Activities should be described and at what level of detail.

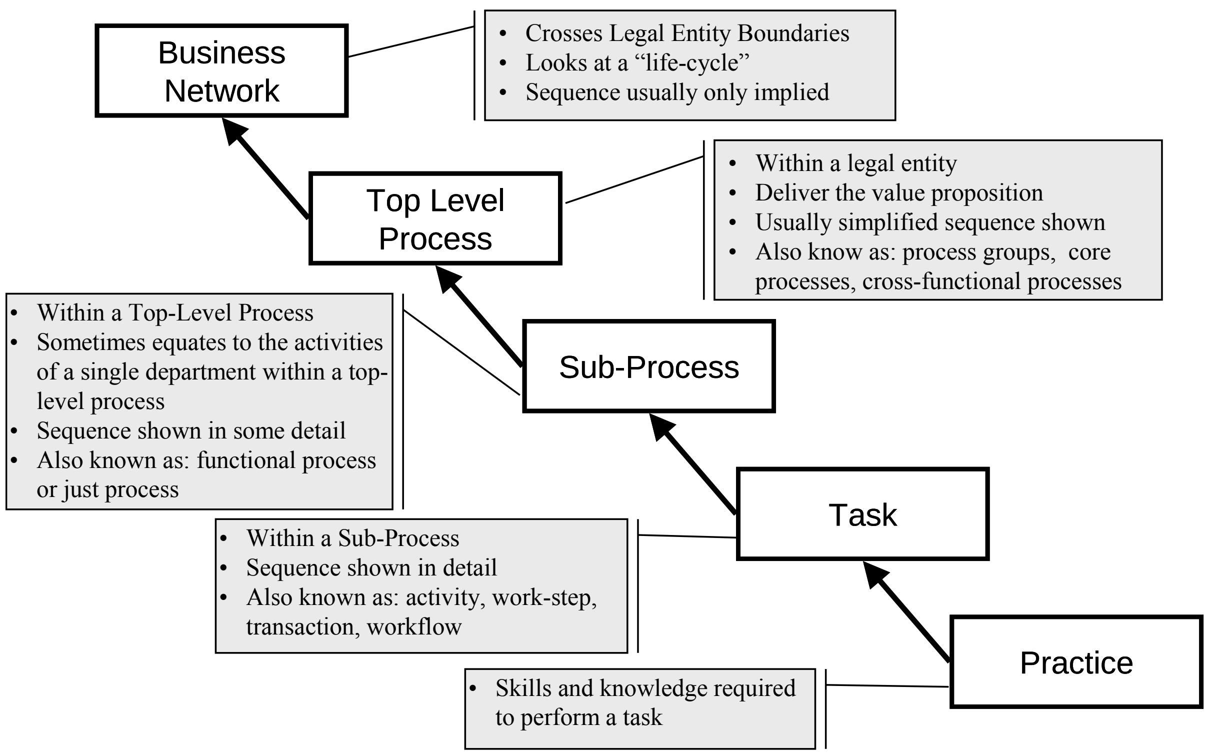

Figure 7-11: Possible Value Configuration Activity Scale Attribute Values

Any combination of any number of scales and sequences of activities may be represented using the SSBMO, depending on the level of detail deemed relevant. This is achieved using the many-to-many recursive relationship between an instance of an Activity and any other instance of an Activity.

Having simplified, based on practical experience, the BMO Value Configuration Types to simply "Product" and "Service", the Activity Type attribute helps the business model

[93] As one example Tenner and DeToro take an entire chapter to "Define and Classify Process" (Tenner & DeToro, 1997, pp.55-64)

designer consider the primary purpose of the work involved in each Activity in relationship to making each value proposition possible. Table 7-64, introduces Hammer's typology of top-level business process types (which Hammer refers to as "process variants") and provides some example Activities.

SSBMO Value Configuration Activity Type	**Description**[94]	**SSBMO Value Configuration Activity Top Level Process Examples**	
		For Value Configuration Type: Product	**For Value Configuration Type: Service**
Core	Activities that convert inputs into outputs of greater or reduced value to stakeholders	Order to Cash Need to Cash	Problem to Provisioned Service Use to Cash Customer Retention
Enabling	Activities that support one or more other activities	Requisition to Pay	
Infrastructure	Activities that create and manage assets used and leveraged by Core activities	Idea to Commercialization Hire to Retire Continuous Improvement	
Governance	Activities that result in decision that direct or modify other activities	Lead & Manage the Business	

Table 7-64: Possible Value Configuration Activity Instances of Scale "Top-Level Process"
(Adapted from Hammer, 1998a, Slide 3-7)

Activities which are part of Value Configurations that result in Decisions are of Type "Governance".

As shown in Figure 7-12, Hammer also offers a model of how these Activity Types are related to both stakeholders, some types of a firm's resources, their contexts and perspectives. This model can help business model designers consider in more detail the

[94] Hammer uses the term "customer" rather than "stakeholder" but his use of the term customer aligns with the definition used here for stakeholder. Hammer notes that Core and Enabling processes are typically transactional in nature, where as Infrastructure and Governance are typically continuous ("Process Varient", defined by Hammer, 1998a, Slide 3-7).

relationships between each Activity and other Activities, Target Stakeholders, Resources and the Context entities.

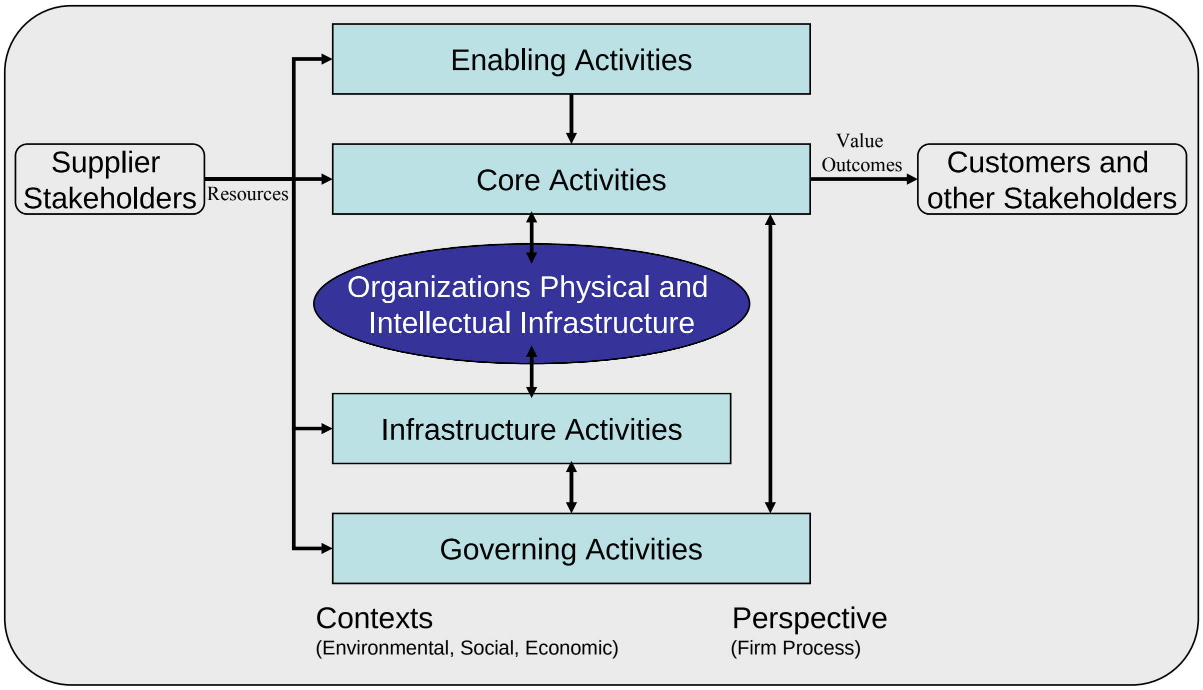

Figure 7-12: Possible Relationships between Value Configuration Activity Types
(Adapated from Hammer, 1998b, Slide 3-8)

7.4.5.10 Eco-System Service

Name	Eco-System Service
Definition	Processes that transform and / or move Bio-Physical Stocks without any involvement of any part of human society. Eco-system Services are conceived based on the benefit flows created for human and other life that may result from this movement and / or transformation (Table 4-5)[95]
Related to **(including cardinality of relationship)**	Eco-System Service *is one part of* Environment (1,1) (Note there is no social or economic context for instances of this entity; this is a definitional attribute of Eco-System Service) Eco-System Services *occurs within the context of Process Perspective* (1,1) Eco-System Service *flows enables* Activities (1,n) (Note this is a mandatory relationship!) Eco-system Service *provided by* Bio-Physical Stocks (1,n) (and Energy, mostly solar, that enables the work that produces the benefit flows)
Cardinality	33, 33 (4 Categories of 24 Services in 33 Sub-Categories, Table 4-5)
Attributes	Name (Identifier) = All characters Description = All characters Benefit Flow Rate = <number> <bio-physical unit> “per” <unit of time> Location = <Geo-spatial / Environmental Location / Area: { <Latitude> “,” <Longitude> “,” <Elevation> } >
References	DDP3 (Table 4-5) DDP6 (Hanson et al., 2008; Hanson et al., 2012)

Table 7-65: Eco-System Service

[95] Benefit flows = nature of the value created. Compare the conception of eco-system services to the conception of “planetary sub-systems” (Table 4-4): these are also processes which transform and / or move Bio-Physical Stocks. However, the function of these sub-systems may or may not have direct benefit to current life.

The Eco-system Service entity encourages the business model designer to consider:

- Which flows of benefits from which eco-system services are used in, harmed by or improved by the creation, delivery and maintenance of your value propositions?
- What are the current benefit flow rates?
- How quickly are these benefit flow rates changing, and what is causing these changes?
- Which of your activities impact these benefit flow rates?
- How do your stakeholders value the benefits from the eco-system services upon which your activities depend, harm or improve?

The flows of benefits from eco-system services are analogous to the 'income' arising from (natural) capital. Since a specific level of income is required to achieve an objective, business model designers are encouraged to consider: what amount of natural capital (bio-physical stocks) is required in order to create enough income (eco-system service benefit flow) for current life to flourish. "System Condition 3" (4.4.3.2) is concerned with depleting natural capital due to its impact on the quantity and quality of subsequent benefit flows from eco-system services. Hence, "System Condition 3" suggests, as expected based on the analogy, that destroying capital without considering its impact on future income levels is risky and likely to lead to 'poverty' (i.e. languishing or mere survival).

Coding the Eco-System Service entity outside of the Social and Financial Economic Context Generalization entities enables the SSBMO to model the practical reality that flows of Eco-System Service benefits on our finite planet are theoretically shareable by all Actors, whether or not they are Target Stakeholder's of the focal firm! Questions of equity, and the role of firms enhancing or reducing Actors perceived equitable access to eco-system service benefits, quickly come into play. Such questions are made more complex because of the current economic and social 'realities', and bio-physical limits, which prevent sharing. As one common, but often unacknowledged physical limitation, is the fundamentally local nature of many benefit flows and their heterogeneous distribution the planet and energy availability (let alone monetary cost) to move a benefit to where it is perceived as needed. For example Primary Production benefit flows (such as Food and Fibre, etc.) can only occur in geophysical locations with appropriate climactic and other conditions that enable crop species flourishing.

However, such challenges do not alter the reality that all life requires a certain minimum quantity and quality of eco-system service flows within specific time periods in order to avoid death, and an increased quantity and / or quality flows to survive, languish or flourish.

Table 4-5 provides a complete list of eco-system services, and allows a business model designer to derive a list relevant to a specific business model[96].

The Eco-System Service

- Benefit Flow Rate gives the business model designer the opportunity to consider the quantity and quality of the flow of benefits arising from each Eco-System Service.
- Location attribute gives the business model designer the opportunity to consider the origin of each Eco-System Service benefit flow (as per DDP6). Location is a constraint imposed by the Environmental Context of an Eco-System Service (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

Finally, in addition to a good overview of eco-systems services and their relationship to firms, a recent report by the Global Reporting Initiative, also has two good examples: a bottled water producer and a shrimp producing aquiculture operation (Boulter, 2011)

7.4.6 Measurement Perspective Entities

7.4.6.1 Introduction and Overview

Based on the overall design principles, DDP5 and DDP6, the SSBMO includes the idea that a business model must include a broadly conceived definition of success and the metrics by

[96] An example of a list of eco-system services relevant for organizations is presented in an instance of the SSBMO produced as part of its evaluation (see SM6).

which its achievement can be ascertained. Success may be defined either at a level minimally acceptable to an organization's legitimized stakeholders (e.g. Ackoffian "goals" or "ends", 3.5.2.2) or as aspirations to which the organization's legitimized stakeholders are committed to strive to achieve. In this case the journey towards, rather than achievement, is considered of ultimate objective (e.g. Ackoffian "ideal-goals", 3.5.2.2).

Given the ultimate environmental, social and monetary context of all firms conceived by the SSBMO, a 'broad definition of success' must, by definition, include elements measured in units applicable to all three contexts.

Business model designers are reminded, as discussed earlier (7.3.3.7), that "not everything that can be counted counts, and not everything that counts can be counted" and that creating and measuring emergent properties such as sustainability outcomes, is not the same as managing a mechanistic production line: "We wish to *attain* the flourishing that sustainability makes possible, not *manage* it" (Italics added Ehrenfeld, 2008, p.106).

Further the SSBMO is not intended as an accounting or reporting tool. The SSBMO only conceptualizes values for metrics in two time periods: current and some planned future. Concepts such as accounting reporting periods are not conceptualized; this is deliberate as such an level of detail is not relevant in a business model.

As noted in Chapter 6, the terminology of measurement is complex. Below are the definitions used by the SSBMO[97]:

[97] This adapted from the author's blog post (Upward, 2012b).

Term	Definition
Definition	Succinct description of a metric which is known to indicate the legitimated stakeholder's conception of organizational success. This can be a an Ackoffian "goal", i.e. acceptable characterization of success or an Ackoffian "ideal", i.e. an aspirational characterization of success. (Each definition should include the unit of measurement, even if this is 'unitless')
Metric or Measure	What needs to be assessed in order to tell if an aspect of a business model or the performance of actual organization meets the definition
Valuation Method	The steps required to determine the value of a metric (i.e. an algorithm or heuristic)[98]
Measurement	Value of and unit for a metric for a business model design (i.e. 'goals' or 'objective') or specific organization (i.e. 'actuals'). These can be numeric, descriptive or a combination.
(Composite) Score	A calculation which agglomerates a group of measurements for the purpose of ease of understanding, decision making and communication. These can be numeric (i.e. a mathematical calculation of a number of measurements), descriptive or a combination.
Threshold	Minimum value of a metrics that if achieved in practice 'prove' an organization meets the definition. This might be expressed as 'target' measurements for each metric.
Impact	The amount of value created that satisfies the environmental and social needs while minimally meeting economic needs of actors[99].
Standard	A collection of threshold measurements or a composite score based on such measurements, e.g. the B Corp requirement of scoring at least 80 out of 200 on their B Corp Impact Assessment Survey for an organization to be allowed to claim they are a Benefit Corporation. Such a standard if defined in relationship to a commonly understood definition of a strongly sustainable organization would constitute a "Sustainable Gold Standard for Business" or a standard for "business impact".
Assessment or Measuring	The process by which measurements are taken for an organization (e.g. completing the B Corp Impact Assessment Survey). Assessment requires the execution of a Valuation Method to determine a Measurement for each Metric.
Evaluation	The process by which it is determined if a collection of Measurements are above or below Threshold of a Standard.
(Compliance) Audit or Certification	The process conducted by a recognized (usually accredited) independent body of the Assessment and Evaluation processes to confirm an organization's compliance with a Standard. If an organization is deemed to be in compliance they are often referred to as being Certified to that Standard.

Table 7-66: Definition of Measurement Terminology

[98] Given our current poor state of knowledge about how to calculate social and environmental metrics, heuristics should be considered rather than failing to attempt to calculate a measure; only through such attempts will the necessary single and double loop learning and hence continuous improvement occur.
[99] (Hornsby, 2012; Sipkens & Thrum, 2012)

The SSBMO radically extends the conception of measurement in the BMO which only considers metrics with monetary units as legitimate. Further the BMO only includes the simplistic conception of success as being 'sufficient' monetary profit, with little thought being given to implications of 'acceptable' or 'ideal' levels of monetary profit on other aspects of a business model (4.5.5.2). The BMO does not include conceptions that allow the measurement of value created or destroyed based on attributes that cannot be 'reliably' valued non-monetarily[100]

In addition to the works cited by Osterwalder (2004a, pp.95-102) the additional works cited in Chapters 3 and 4 from which the design principles were derived provide theoretical support for this amended conception of the entities within the Measurement Perspective of a strongly sustainable business model. Specifically see 4.6.5.2 for the introduction to "Tri-Profitability".

Together instances of the specific entities within the Measurement Perspective describe: "How each firm in a business model defines and measures its success".

For simplicity of conception and understanding the SSBMO, with one exception, does not use or invent new terminology in these extended conceptions. Rather it 'overloads' or generalizes the meaning of a range of common classes of financial metrics. Upon reflection this risks leaving a business model designer with the impression that the SSBMO, like the BMO, only considers monetary metrics valid. However, it is hoped the relationship of each of the measurement entities with the Environment, Social and financial Economy Context Generalization entities minimizes this risk.

Table 7-67 lists the common classes of financial metrics 'overloaded' in the SSBMO. The table provides for each class: the commonly understood monetary meanings and the suggested addition environmental and social meanings. The measurement units for each combination of class and context are also introduced.

[100] 'Pricing' is the economic term for calculating the value something in monetarily units. Despite the majority view in the Global North to the contrary, in fact pricing is known to be highly unreliably for many categories of things in many decision contexts (Balmford, Bruner, Cooper, & Costanza, 2002; Farley, 2008; Gintis, 2000; Hayek, 1945; Krupnick et al., 2002; Lawn, 2001; Norgaard, 1990; Schwindt, Vining, & Globerman, 2000; Solow, 1974; Transport Canada, 2008).

It should be remembered that even in the original financial meanings:

- Revenues, costs and profit are measures of the flow of money during a period of time, appearing on a (usually annual) financial Profit and Loss statement (Income Statement or Statements of Account).
- Assets are measures of stocks (of money) accumulated or owed (liabilities) at a point in time, appearing on a (usually annual) Balance Sheet Statement (Statement of Financial Position). The differences between the assets at two points in time appear on a Statement of Changes. The differences between quantities of liquid assets at different points in time (cash in the monetary context) appear on a Cash Flow Statement.

The one new class of metric is "tri-profit" (introduced and explored in 4.6.5.2). As far as is known, this is a neologism, defined as follows:

> Tri-Profit is a metric calculated as the conceptual 'sum' of the net harm or benefit arising as a result of firm's activities in each of the environmental, social and economic contexts in a given time period.

Common Class of Metric (Overloaded Concepts)	Definition of Class in each Context		
	Environmental	Social	Monetary
Revenue (Increase in Satisfaction, Benignity, Benefit, Equity, Transparency, i.e. Value Created)	A flow at a point in time: Absolute quantity of Biological Nutrient Resource 'returned' to a Bio-Physical Stock **or** Increase in absolute quantity or quality of benefit flow from an Eco-System Service	Any positive impact on any Target Stakeholder created	Quantity received from other Target Stakeholders
Cost (Increase in Toxicity, Harm, Inequity, Opaqueness, i.e Value Destroyed)	A flow at a point in time: Absolute quantity of a Bio-Physical Stock moved or transformed **or** Decrease in absolute quantity or quality of benefit flow from a Eco-System Service	Any negative impacts on any Actor created intentionally or unintentionally	Quantity given to other Target Stakeholders
Asset (Capital, Equity, Liability)	Total stock of Tangible Resources to which the firm has 'privileged access to' (moral or ethical duty towards)	Total stock of Relationship Equity, generated by some portion of social profit.	Total quantity 'controlled' by the firm
Profit / Loss (Net Benefit/Harm, Net Value Created/Destroyed)	Difference between Environmental Revenue and Cost	Difference between Social Revenue and Cost	Difference between Monetary Revenue and Cost
Tri-Profit / Tri-Loss	Unitless score which agglomerates or conceptually sums-up, the individual environmental, social and monetary profits (losses).		
Measurement Unit	SI Units, e.g. Mass (kg), Concentration (Mol), Size (m), Time (s), Energy (J), etc.	Flourishing "Units"[101]	Currency Units

Table 7-67: SSBMO Measurement Terminology

The SSBMO does not use a range of terms commonly used by managers when considering definitions, measurement and communication of firm success. Terms such as: 'mission', 'vision', 'values', 'success factors', 'goals', 'key performance indicators', and 'balanced

[101] While there is much work in the positive psychology to understand the differences between death, survival, languishing and flourishing, happiness/sadness, unfulfilled/fulfilled, illness/wellness, having/being, harm/welfare, commonly defined units for such concepts, let alone techniques for their reliable measurement at a range of scales (person, group, community, city, region, country) largely do not exist (4.4.3.2 Flourishing).

scorecard'. Upon exploration such conceptions are found to be unhelpful in the design of business models. Instead the business model designer is encouraged to consider how either:

- The underlying concepts of success definition and measurement can be more completely modelling using the entities in the Measurement Perspective of the SSBMO than is typically possible using the terms listed
- An entire business model described using the SSBMO can be used to provide the details to back-up the typically 'pithy' statements associated with each of the terms listed above. Alternatively the business model can be used to derive such statements.

Summarizing: the SSBMO enables the description of the substantive and practical elements of a business model design. If acted upon, such a design provides meaningful detail normally missing from organization's mission, vision and value statements.

The specific entities in the SSBMO Measurement Perspective can easily be used, as per ODP2, to describe firms choosing to value environmental, social and economic success solely in monetary units, such as "Triple Bottom Line" approaches (Elkington, 1999). However, based on the shared (K0) and strongly sustainable (K0-SS) literature reviewed in Chapters 3 and 4, this is not viewed as the most effective way of creating a strongly sustainable business model design.

Largely, this is because of the human judgements required to convert the units of a given metric from its biophysical or social base to ones of monetary currency. This is the same challenges faced by the common management cost accounting technique of Activity Based Costing. Such approaches lead to significant disagreements concerning the details and judgements involved in such conversion calculations. Little time is then spent on using the results to inform improved decisions and decision making. In other words manipulating the units of a metric, particularly towards ultimately arbitrary monetary units, makes understanding, and trade-off or satisficing decisions more opaque and risky.

7.4.6.2 Valuation Method

Name	Valuation Method
Definition	The steps to create the value of a metric which is indicative of achieving the success of a firm in any unit of measure considered valid. When followed, the steps of a Valuation Method results in a measurement for one class of metric.
Related to **(including cardinality of relationship)**	Valuation Method *occurs within the context of* Environment (1,1) Valuation Method *sometimes occurs within the context of* Society (0,1) and/or Financial Economy (0,1) Valuation Method *occurs within the context of* Measurement Perspective (1,1) (i.e. Valuation Methods are unique to a Firm) Valuation Method *requires as input* Asset (1,n) (note mandatory with respect to one of Cost, Revenue or Process Metric) [102] Valuation Method *requires as input* Cost (1,n) (note mandatory with respect to one of Asset, Revenue or Process Metric) Valuation Method *requires as input* Revenue (1,n) (note mandatory with respect to one of Asset, Cost or Process Metric) Valuation Method *requires as input* Process Metric (1,n) (note mandatory with respect to one of Asset, Cost or Revenue) Valuation Method *produces as output* Asset (1,1) (note mutually exclusive with Cost, Revenue and Process Metric)[103] Valuation Method *produces as output* Cost (1,1) (note mutually exclusive with Asset, Revenue and Process Metric) Valuation Method *produces as output* Revenue (1,1) (note mutually exclusive with Asset, Cost and Process Metric) Valuation Method *produces as output* Process Metric (1,1) (note mutually exclusive with Asset, Cost and Revenue) Valuation Method *concerns the valuation of* Process Metric (0,n) (note mutually exclusive with Offering and Link)[104] Valuation Method *concerns the valuation of* Offering (0,n) (note mutually exclusive with Process Metric and Link) Valuation Method concerns the valuation of Link (0,n) (note mutually exclusive with Process Metric and Offering) [104]

[102] i.e. A Valuation Method may use as inputs to its calculation one or more of Asset, Cost, Revenue and Process Metric measurements.
[103] i.e. A Valuation Method may only produce a single output of one class: Asset, Cost, Revenue or Process Metric measurements.
[104] i.e. A Valuation Method may be valuing only one of a Process Metric, Offering or Link.

<table>
<tr><th>Name</th><th>Valuation Method</th></tr>
<tr><td>Cardinality</td><td>6,n
(The focal firm of a business model must have a valuation method for each of environmental, social and financial revenue and cost in order to calculate its Tri-Profit)</td></tr>
<tr><td>Attributes</td><td>Name (Identifier) = All characters
Description = <Steps and their Sequence to Determine Measurement>
Output Class = “Asset” | “Cost” | “Revenue” | “Process”
Unit Type = “Bio-Physical” | “Social” | “Monetary” | “Unit Less”
Units = <unit of valuation method output>
Type =
<Process Valuation Method for Metrics of Quantity, Quality, Timeliness, Satisfaction, Efficiency, Effectiveness, etc.> |
<Environmental Valuation Method for Metrics of Concentration or Flourishing> |
<Social Valuation Method for Metrics of Well-being> |
<Economic Valuation Method for Metrics of: <Monetarily Valued Assets: “At Cost” | “Depreciated” | “Assessed Current Value”> | <Monetary Cost: “Buying” | “Borrowing” | “Using”> | <Monetary Revenue: “Selling” | “Lending” | “Licensing” | “Transaction Cut” | “Advertising”> >[105]
[Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> “,” <Longitude> “,” <Elevation> } >]</td></tr>
<tr><td>References</td><td>(Osterwalder, 2004a, Table 37 pp.96-101)
DDP5
DDP6
(Balmford et al., 2002; Farley, 2008; Gintis, 2000; Hayek, 1945; Krupnick et al., 2002; Lawn, 2001; Norgaard, 1990; Schwindt et al., 2000; Solow, 1974; Stern, 2006; Stiglitz, Sen, & Fitoussi, 2009; TEEB, 2010; Transport Canada, 2008)</td></tr>
</table>

Table 7-68: Valuation Method

[105] “Selling” | “Lending” | “Licensing” | “Transaction Cut” | “Advertising” are the possible values of the Stream Type attribute of the Revenue Stream and Pricing element of the BMO (Explained at some length in Osterwalder, 2004a, pp.97-98). See Table 7-69 for the possible values of the Valuation Method Type attribute which extends the Stream Type attribute to accommodate the three contexts of the SSBMO.

The Valuation Method entity encourages the business model designer to consider how the measurement of the business model can be undertaken:

- How does your organization measure the things that define success?
- How do you calculate metrics of environmental, social or monetary costs, revenues or assets from:
  - Process metrics, i.e. metrics of Activities and the Resources as they move or are transformed (e.g. quantity, quality, timeliness, satisfaction, efficiency, effectiveness, etc.)
  - The value your stakeholders place on your Value Propositions (Offerings or Links), i.e. outcomes, how your Value Propositions, as satisfiers help Target Stakeholder Actors' fulfill their Needs

Typically customer stakeholders are willing to pay to receive a value proposition via a price, the sum of which over a period of time creates a firm's revenue stream. Economic valuation for costs, revenues and assets is called pricing. Hence the BMO only conceptualizes the monetary benefit valuation process, i.e. how one determines the monetary value of potential revenue streams via the monetary price of one or more Value Proposition Offerings.

Osterwalder suggests there are three types of revenue pricing mechanisms or "pricing methods": "Fixed", "Differential", and "Market" (Osterwalder, 2004a, Illustration Box 15, Table 38 & Theory Box 7 pp.98-101).

As described in 7.4.6.1 the SSBMO dramatically extends this conception in four ways:

1. The ultimate environmental and social contexts of all firms requires the explicit and thorough consideration of how definitions of success related to these contexts can be calculated, i.e. how can environmental and social revenues be measured?
2. The recognition that firms can create and destroy value for stakeholders requires explicit and thorough consideration of how definitions of harm related to all three

contexts can be calculated, i.e. how can environmental, social or monetary costs be measured?

3. The recognition that firms depend upon and can create, destroy and accumulate stocks of capital to which the firm has ‘privileged access’ over time (i.e. assets, equity, liability etc.) requires explicit and thorough consideration of how quantities of such stocks:
   - Can be measured in relationship to all three contexts at given points in time
   - Relate to the flows of revenues and /or costs over time.
4. The recognition that the calculation of Revenues, Costs and Assets may require measurement of any aspect of a Firm’s Processes, e.g. an environmental cost may be related to Kg/CO_2e generated by all Activities in a business model. Such process metrics may also be complex, and hence also require consideration of how such measurements are to be made.

Hence, as shown in Figure 7-13, Valuation Method is conceived as a description of the steps required

1. Concerning the measurement of the value of an instance of one or more Offerings, Links or Process Metrics.
2. That use existing measurements of Assets, Costs, Revenues or Process Metrics as inputs.
3. To determine a value (i.e. an algorithm or heuristic).
4. That results in the output of a measurement of an Asset, Cost, Revenue or Process Metric.

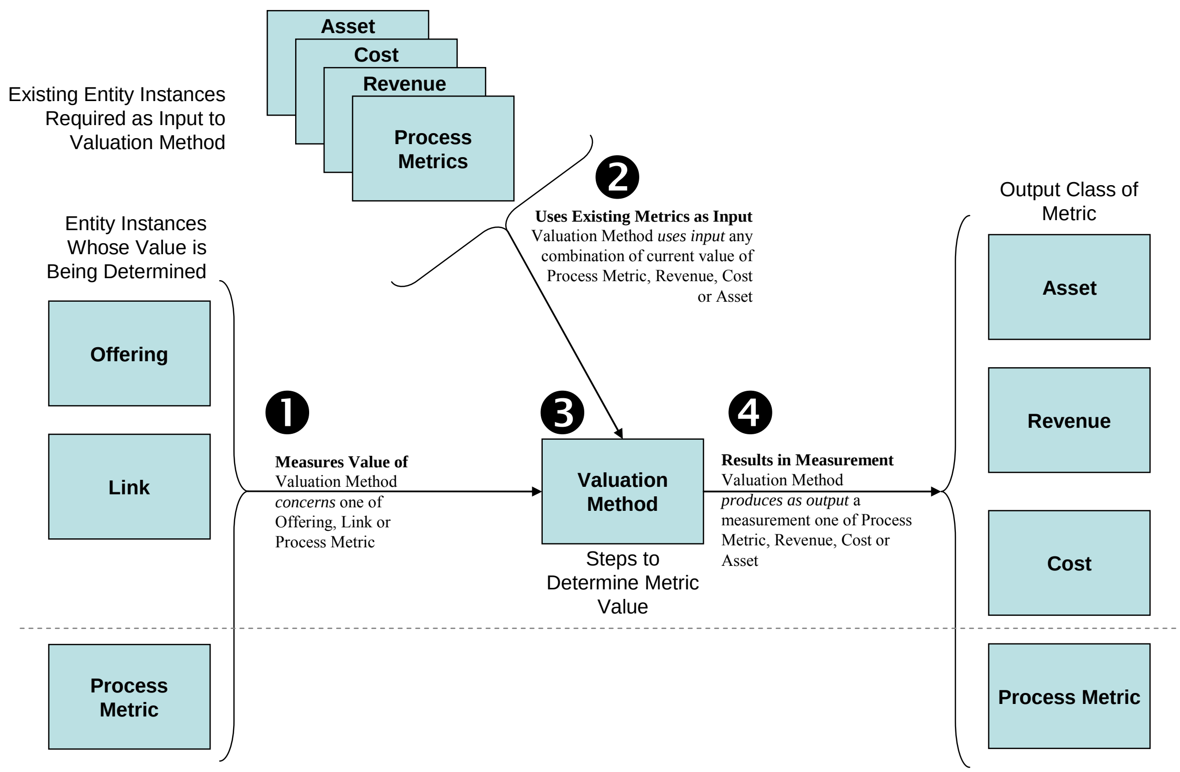

Figure 7-13: Concerns, Inputs and Outputs of Valuation Method Instances

As shown in Figure 7-13 by its appearance somewhat apart from other entities, business model designers are reminded that Process Metric measurements (valuation) may be undertaken for a variety of reasons; and not necessarily because such metrics are meaningful to Target Stakeholder Actors in relationship to the satisfaction of their Needs. On the other hand, by definition, Assets, Revenues and Costs always measure the value created or destroyed for stakeholders by an Offering (or Link).

Technically, any characteristic of a process (i.e. an Activity and the associated Resources) that has value to a stakeholder should have an associated Value Proposition Offering (and as necessary a Channel Link), i.e. characteristics such as quantity, quality, timeliness, satisfaction, efficiency and effectiveness may all play a role in satisfying Stakeholder Actor Needs.

In such cases, the Offering describes the value of the process characteristic: i.e. how it meets the associated Target Stakeholder Criterion. Further, the Offering (or a Link) will also have a Valuation Method that describes how to calculate that value in what ever units are relevant.

Despite these differences from the other Measurement perspective entities, Process Metric is included as a concern of Valuation Method since:

- The calculation method for each Process Metrics can be non-trivial in of themselves.
- The overall concept of a valuation method applies whether or not the metric is of direct importance to a Target Stakeholder or not.

Business model designers are also reminded that most Relationship Equity will also be valued in the same way as process characteristics of concern to stakeholders: i.e. via a Relationship Value Proposition and its associated Offerings.

However, in practice business model designers will realize that, while conceptually monetary costs also do harm to certain stakeholders, and hence should have an associated (negative) value proposition, in practice it may be easier to relate a process metric (such as number of hours worked) to a valuation method (such as pay employees), and a cost recorded (in a salary account).

The Valuation Method:

- Output Class gives the opportunity for the business model designer to consider whether a Valuation Method is a calculation concerning a metric of
  - A stock of something (Asset) which accumulates or reduces over time
  - A flow of good (Revenue) or harm (Cost) at a point in time
  - Either a stock or a flow of a characteristic of a Process (i.e. concerning an Activity and / or the Resourced involved).
- Unit Type and Units gives the opportunity for the business model designer to describe the nature of the output of a Valuation Method.

- Type gives the opportunity for the business model designer to consider the nature of a Valuation Method and its comparative strengths and weaknesses related to the organization's definition of success and the Needs of the Target Stakeholder Actors.
- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Valuation Method (as per DDP6). Location can be considered as part of the Social Context of an Valuation Method (i.e. relative to the location of other human actors or a socially defined area, such as a specific market-place or country) or a constraint imposed by the Environmental Context of a Valuation Method (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

Understandably Osterwalder spent some considerable time and effort defining the possible "stream types" of the BMO Revenue Stream and Pricing element. All these definitions are still applicable for monetary revenue metrics. Table 7-69 includes Osterwalder's definitions but adds, based on a synthesis from the literature, possible values of the Valuation Method Type attribute for:

- Monetary Costs, Assets and Process Metrics
- Social Revenues, Costs, Assets and Process Metrics
- Environmental Revenues, Costs, Assets and Process Metrics

Business model designers may wish to consider these types as they describe and determine how to perform the calculations of their business model metrics of success.

Unit Type	Output Class(es)	Possible Type Values*	Type Definition / Example / Reference
Biophysical	Asset Cost Revenue	Eco-System Service Flourishing, Bio-Physical Stock at a given Concentration	Metrics relevant to Tables 4-5 and 4-6 respectively.
Biophysical (and possibly Monetary)	Process	Quantity, Quality, Timeliness, Reliability, Safety, Efficiency	Quantity of Resource, Quality of Resource, Timeliness of Activity in relation to a Threshold, Efficiency with which an Activity moves or transforms Resources
Social (and possibly Monetary)	Process	Satisfaction, Completeness, Consistency, Safety, Effectiveness, Outcome	Customer Satisfaction, Employee Satisfaction, Effectiveness of an Activity that makes possible a Channel Link.
Social	Asset Cost Revenue	Death, Survival, Languishing and Flourishing Happiness / Sadness Unfulfilled / Fulfilled Illness/ Wellness, Having / Being, Harm / Welfare	TBD
Monetary	Asset	"At Cost"	Measurement based on original monetary price.
		"Depreciated"	Measurement based on original monetary price, reduced based on some function of time.
		"Assessed Current Value"	Measurement based on the estimated price that could be charged in the market.
Monetary	Cost	"Buying" or "Paying"	Measurement based on price charged, usually set in the terms and conditions of a Partnership Agreement.
		"Borrowing"	Measurement based on price for gaining privileged access to a Tangible Resource.
		"Using"	Measurement based on occurrences of value received from a Tangible Resource
Monetary	Revenue	"Selling"	(Osterwalder, 2004a, pp.97-98) via pricing mechanisms: – "Fixed: Pay-per-Use, Subscription, List price / menu price" – "Differential: Product / Feature Dependent, Customer Characteristic Dependent, Volume Dependent, Value-Based" – "Market: Bargaining, Yield Management, Auction, Reverse Auction, Dynamic Market"
		"Lending"	
		"Licensing"	
		"Transaction Cut"	
		"Advertising"	

* Items in quotations are well understood and defined.

Table 7-69: Possible Valuation Method Type Attribute Values

7.4.6.3 Tri-Profit

Name	Tri-Profit
Definition	The net harm or benefit arising as a result of firm's activities in each of the environmental, social and economic contexts in a given time period. Unitless score which agglomerates (conceptually sums-up), the individual environmental, social and monetary profits (losses) in a given time period.
Related to (including cardinality of relationship)	Tri-Profit *occurs within the context of* Environment (1,1), Society (1,1) and Financial Economy (1,1) Tri-Profit *occurs within the context of* Measurement Perspective (1,1) (i.e. Tri-Profits are unique to a Firm) Tri-Profit *is categorized using a* Account (1,1) Tri-Profit *'sums-up'* Revenues (n,n) (note: ***all*** revenues in all three contexts) Tri-Profit *'sums-up'* Costs (n,n) (note: ***all*** costs in all three contexts) Tri-Profit s*core is calculated by 'summing-up' the difference between the 'sum' of each* Revenues *and the 'sum' of each* Costs *in each of the three contexts and recording the result in an* Account.
Cardinality	1,1 (Conceptually a Firm has precisely one level of Tri-Profit at a point in time, although this may vary by Location)
Attributes	Description = <A Firm's definition of success and the steps required to calculate Tri-Profit> [Current Value = <unitless Tri-Profit (Loss) Score> <time period to which it applies, month, year, five years etc.>] (Optional only if SSBMO is describing a desired new business that does not currently exist) [Planned Value = <unitless Tri-Profit (Loss) Score> <time period to which it applies, month, year, five years etc.>] (Optional only if SSBMO is describing a current business) [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]
References	(Osterwalder, 2004a, Fig.49 p.95) DDP5 DDP6, 4.6.5.2 (Blattberg, 2000)

Table 7-70: Tri-Profit

The Tri-Profit entity encourages the business model designer to consider the total amount of current or desired net benefit as identified by the legitimated stakeholders, and how this might be calculated:

- How does the organization choose to calculate profit – environmentally, socially, financially?
- How are the costs 'subtracted' from the revenues for each of environmental, social and monetary costs and revenues? (each in their own units)

Somewhat surprisingly the BMO, while including a Profit element in its diagrammatic form, omits to define it. On the other hand this only supports the overall criticism of the BMO which served to initiate this research.

The Tri-Profit:

- Description attribute gives the business model designer the opportunity to consider with the firm's legitimated stakeholders what the 'acceptable' or 'aspirational' definition of success and how this will be calculated from the underlying environmental, social and financial profits (costs subtracted from revenues).
- Current and Planned Value attribute gives the business model designer the opportunity to record the current and planned values of the flow of Tri-Profit over a defined period.
- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for their Tri-Profit (as per DDP6). Location can be considered as part of the Social Context of Tri-Profit (i.e. relative to the location of other human actors or a socially defined area, such as a specific place or country) or a constraint imposed by the Environmental Context of Tri-Profit (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

As noted in Table 4-15, decision making around the fundamentally inter-disciplinary tri-profit concept is considerably more cognitively complex than decision making using the single sub-disciplinary defined monetary profit.

For example the 'summation' and 'subtraction' operations required to calculate Tri-Profit may necessarily require the legitimated stakeholders to make judgements based an agreement that integrates their perspectives of firm success based on their individual world-views.

It remains to develop the decision rules for tri-profit. Such rules might be referred to as a "Tri-Profit Calculus" and might include:

- Identification of component variables (the identification and description of the specific entities in the SSBMO Measurement Perspective is perhaps a starting point).
- Identification of their inter-relationships (the identification and description of the relationships between the specific entities in the SSBMO Measurement Perspective is perhaps a starting point).
- Descriptions of the assumptions and method for calculation. As noted the methods for reliably calculating many of the variables of Tri-Profit do not exist[98, 101]. However, even if monetary pricing was reliably useful, based on the literature reviewed bringing everything into the financial economy would clearly be counter productive.
- Tools to help managers
  - Understand the dynamics of the component variables of tri-profit over-time[106]
  - Effectively communicate tri-profit values at points in time and changes over time
  - Maximize it[107].

[106] Systems Dynamics modelling might be of particular use in this regard, especially given is use in macro economic, business network and firm process modelling (Boumans et al., 2002; Repenning & Sterman, 1997; Repenning & Sterman, 2001; Sterman, 2000; Sterman, Repenning, & Senge, 2000; Victor, 2008).

- Tools to help impact investors rate and rank firms reporting tri-profit.

A Tri-Profit Calculus

Synthesizing from the literature reviewed (Chapter 3 and 4) a set of possible propositions that would need to be captured by a Tri-Profitability Calculus for Firms are:

1. Financial assets and profit (monetary revenues less monetary costs) can grow unlimited in any time period so long as environmental and social costs remain the same or decrease (Principle from Ecological Economics).
2. Social and monetary assets can grow in an unlimited fashion as long as the environmental assets to which the firm has privileged access remain the same or go down (in absolute scientific units) (Principle from Ecological Economics).
3. All costs and revenues should be equitably distributed to all stakeholders in all locations (Aspirational, based on "Natural Laws of Sustainability", from Doppelt, 2012 and principles from Ecological Economics).
4. In all cases:
   – Absolute levels of environmental and social costs must be minimized (in scientific units), while environmental and social revenues (benefits) are maximized, i.e. the benefits may not go down although costs may (Principle from idea of abundance in the face of the limits of the semi-open system of planet Earth, from McDonough & Braungart, 2002).

[107] Recognizing that one may not maximize all three of the component profits: environmental, social and environmental, maximizing Tri-Profit will necessarily involve satisficing the underlying variables. Visual presentation techniques such as 'radar charts' will likely be important.

– Level of financial profit (monetary revenue less costs) must be maximized relative to other comparable firms, i.e. financial costs and revenues can grow, but the relative difference to other firms must also increase (this implies that some stakeholders have a need for competition in the financial context in order for them to meet their needs)

Possible examples of decision rules arising from the interaction of these propositions includes:

- Irrespective of monetary price relative to revenue, minimize absolute flow of priced bio-physical resources (Example from Ecological Economics).
- Maximizing financial revenues and minimizing financial costs may only be done if this tends to increase environmental and social revenues while reducing those costs.
- Advice to managers as applied ecologists (4.6.3.4).

Finally, it is worth considering whether other financially important terminology, such as bankruptcy, need to be reconceptualised, as profit has been here. Perhaps bankruptcy needs to be reconceptualised to include social and / or environmental as well as financial insolvency. After all, if we assume the current form of capitalism is to remain the basis of our economy, we want firms which maximize tri-profit to be able to out-compete less tri-profitable firms, causing the firms with lower levels of tri-profit to cease to exist.

Such creative destruction will inevitably cause significant harm to the stakeholders of the firms and whole industries that fail. However, it appears to be the only process demonstrated to enable the restructuring that leads to a new round of growth and accumulation, while enabling some degree if individual freedom of thought and action (terminology of panarchy applied to the community of all firms, Figure 4-4) (Upward, 2011).

7.4.6.4 Account

Name	(Revenue, Cost, Asset, Tri-Profit) Account
Definition	A category for each Revenue, Cost, Asset and the Tri-Profit metric. A grouping for a set of conceptually related Revenue, Cost or Asset metrics.
Related to **(including cardinality of relationship)**	Account *occurs within the context of at least one part of* Environment (0,1), Society (0,1) and/or Financial Economy (0,1) (An account does not have to be related to the environment, but it must be related to at least one context, possibly more than one) Account *occurs within the context of* Measurement Perspective (1,1) (i.e. Accounts are unique to a Firm) Account *groups another* Account (0,n; 1,1) (Note optionality) Account *tracks Tri-Profit* (1,1) (Note mutually exclusive with Revenue, Cost and Asset; each account stores exactly one value of one Valuation Method Output Class, excluding Process Metric) Account *tracks* Asset (1,1) (Note mutually exclusive with Tri-Profit, Revenue, and Cost; each account stores exactly one value of one Valuation Method Output Class, excluding Process Metric) Account *tracks* Cost (1,1) (Note mutually exclusive with Tri-Profit, Revenue and Asset; each account stores exactly one value of one Valuation Method Output Class, excluding Process Metric) Account *tracks* Revenue (1,1) (Note mutually exclusive with Tri-Profit, Cost and Asset; each account stores exactly one value of one Valuation Method Output Class, excluding Process Metric)
Cardinality	1,n
Attributes	Name (Identifier) = All characters, but typically a number. Description = All characters
References	(Osterwalder, 2004a, Table 40 p.102) DDP5

Table 7-71: (Revenue, Cost, Asset, Tri-Profit) Account

The Account entity encourages the business model designer to consider the Revenues, Costs, Asset and Tri-Profits of all the firms in a business model:

- How to reliably record values of each class of metric
- Structure and report planned and actual values of each class of metric

Typically there is one account for each instance of each class of metric, i.e. there will be many Revenue, Cost, Asset and Profit accounts, as there will be many aspects and categories of each of these classes of metrics.

Building on the traditions of financial and managerial accounting:

- Using the concept of an account facilitates the accurate and consistent understanding, and communication of a firm's actual and planned definition of success
- All the accounts used by a firm are called a firm's chart of accounts.

The Account:

- Name and description gives the business model designer the opportunity to consider how to categorize and group the success metrics in order to facilitate understanding and communication of a firms actual and planned definition of success.

  Financial reporting account names and definitions are legally mandated or are a matter of (strict) convention in many countries. Standards for naming and defining environmental and social accounts do not currently exist. However, it is expected that standards will come to exist for environmental and social accounts over time as a result of work by the Sustainability Accounting Standards Board (SASB) and other accounting, reporting and ratings standards organizations.

- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for each Account (as per DDP6). Location can be considered as part of the Social Context of an Account (i.e. relative to the location of other human actors or a socially defined area, such as a specific market-place or country) or a constraint imposed by the Environmental Context of an Account (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

7.4.6.5 Process Metric

Name	Process Metric
Definition	An aspect of an Activity that can be measured related to a firm's definition of success agreed by its legitimated stakeholders.
Related to **(including cardinality of relationship)**	Process Metric *occurs within the context of at least one part of* Environment (0,1), Society (0,1) and/or Financial Economy (0,1) (A Process Metric does not have to be related to the environment, but it must be related to at least one context, possibly more than one) Process Metric *occurs within the context of* Measurement Perspective (1,1) (i.e. Process Metrics are unique to a Firm) Process Metrics *are measured using* Valuation Method (0,1) ("*Concerns*" and "*Produces as Output*": Note optionality: not all Process Metrics need to be calculated; some may be measured by direct examination of an Activity) Process Metrics *are inputs to* Valuation Method (0,n) (Note optionality: Process Metrics may simply be interesting, and not used to calculate another class of metric) Process Metric *concerns* Resource (0,n) (Note optionality: a Process metric may defined only in relationship to process performance, e.g. duration, such as "time to serve a customer") Process Metric *measures* Activity (1,1)
Cardinality	1,n
Attributes	Name (Identifier) = All characters Description = All characters Unit Type = "Bio-Physical" | "Social" | "Monetary" | "Unit Less" [Current Value = <description> | <number> <units> <historic time period over which flow is summed, month, year, five years etc.> | <historic point in time at which amount of stock is recorded>] (Optional only if SSBMO is describing a desired new business that does not currently exist) [Planned Value = <description> | <number> <units> <future time period over which flow is summed, month, year, five years etc.> | <future point in time at which amount of stock is recorded>] (Optional only if SSBMO is describing a current business) [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]
References	DDP5

Table 7-72: Process Metric

The Process Metric entity encourages the business model designer to consider what measurements of which Activities (and the associated Resources) help to define success:

- How does your organization measure those aspects of your processes that define success (e.g. Quantity, Quality, Timeliness, Reliability, Safety, Efficiency, Satisfaction, Completeness, Consistency, Safety, Effectiveness, Outcomes, etc.)
- Are these metrics stocks at a given point in time (e.g. Resources), or totals of flows over a given period of time (e.g. movements and transformations of Resources created by Activities)?

Process Metrics for 'simple' quantities of such things as Raw Materials and CO_2e are conceived, along with Process Metrics resulting from the calculation involving other Process Metrics, Assets, Costs, Revenue (e.g. cost per unit of finished goods; assets per employee, revenue per sale etc.). The calculations for such 'complex' metrics are described by an associated Valuation Method.

To contribute to Tri-Profit a process measure must have an associated Valuation Method instance whose Output Class is Cost or Revenue.

The Process Metric:

- Description attribute gives the business model designer the opportunity to consider with the firm's legitimated stakeholders what the 'acceptable' or 'aspirational' definition of each Process Metric, how this is generated, and how its calculation may be based on underlying environmental, social and financial process metrics.
- Unit Type and Units gives the opportunity for the business model designer to describe the nature of each Process Metric, and identify whether it is a stock or a flow.
- Current and Planned Value attribute gives the business model designer the opportunity to record the current and planned values of each Process Metric..
- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for their Process Metrics (as per

DDP6). Location can be considered as part of the Social Context of a Process Metric (i.e. relative to the location of other human actors or a socially defined area, such as a specific place or country) or a constraint imposed by the Environmental Context of a Process Metric (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

7.4.6.6 Revenue

Name	Revenue
Definition	A metric of a flow of value created over a period of time – environmentally, socially or monetarily – considered important to a firm's definition of success agreed by its legitimated stakeholders.
Related to **(including cardinality of relationship)**	Revenue *occurs within the context of at least one part of* Environment (0,1), Society (0,1) and/or Financial Economy (0,1) (A Revenue metric does not have to be related to the environment, but it must be related to at least one context, possibly more than one) Revenue *occurs within the context of* Measurement Perspective (1,1) (i.e. Revenues are unique to a Firm) Revenues *are measured using* Valuation Method (1,1) Revenues *are inputs to* Valuation Method (0,n) (Note optionality) Revenue *are 'summed-up' by* Tri-Profit (n,n) (note: ***all*** revenue in each context) Revenue *is categorized using* Account (1,1)
Cardinality	3, n (The focal firm of a business model must have at least one environmental, social and financial revenue metric in order to calculate its Tri-Profit)
Attributes	Name (Identifier) = All characters Description = All characters Unit Type = "Bio-Physical" | "Social" | "Monetary" | "Unit Less" [Current Value = <description> | <number> <units> <historic time period over which the flow of revenues are summed, month, year, five years etc.>] (Optional only if SSBMO is describing a desired new business that does not currently exist) [Planned Value = <description> | <number> <units> <future time period over which flow of desired revenue is summed, month, year, five years etc.>] (Optional only if SSBMO is describing a current business) [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]
References	(Osterwalder, 2004a, Table 36 pp.95-96) DDP5 DDP6, 4.6.5.2 (Blattberg, 2000)

Table 7-73: Revenue

The Revenue entity encourages the business model designer to consider the quantity of current or desired benefit flow as identified by the legitimated stakeholders over a given period of time and how this is generated from a firm's Offerings (and the Firm's Processes that deliver them via its Channel Links):

- How does the organization choose to measure the value of the revenue generated by your offerings?
- Do you measure revenue in Financial terms (e.g. payments received from customers), Social terms (e.g. increased happiness, wellbeing etc.), and / or Environmental terms (e.g. contribution to quality or quantity of bio-physical stocks or eco-system service flows) (Each in its own units)?
- How are revenue metrics calculated by your valuation methods to measure the value created by each Offering (or Link)?

Unlike the BMO, which only conceptualized a monetary Revenue Model element, the SSBMO includes a broad conception of Revenue metrics as any measure of value created over a period of time, e.g. an increase in: satisfaction, benignity, benefit, equity, and / or transparency, etc.

The Revenue:

- Description attribute gives the business model designer the opportunity to consider with the firm's legitimated stakeholders what the 'acceptable' or 'aspirational' definition of revenue, how this is generated, and how its calculation may be based on underlying environmental, social and financial process metrics.
- Unit Type and Units gives the opportunity for the business model designer to describe the nature of each Revenue metric.
- Current and Planned Value attribute gives the business model designer the opportunity to record the current and planned values of the flow of Revenue over a defined period.

- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for their Revenues (as per DDP6). Location can be considered as part of the Social Context of a Revenue metric (i.e. relative to the location of other human actors or a socially defined area, such as a specific place or country) or a constraint imposed by the Environmental Context of a Revenue metric (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

7.4.6.7 Cost

Name	Cost
Definition	A metric of a flow of value destroyed over a period of time – environmentally, socially or monetarily – considered important to a firm's definition of success agreed by its legitimated stakeholders.
Related to **(including cardinality of relationship)**	Cost *occurs within the context of at least one part of* Environment (0,1), Society (0,1) and/or Financial Economy (0,1) (A Cost metric does not have to be related to the environment, but it must be related to at least one context, possibly more than one) Cost *occurs within the context of* Measurement Perspective (1,1) (i.e. Revenues are unique to a Firm) Cost *are measured using* Valuation Method (1,1) Cost *are inputs to* Valuation Method (0,n) (Note optionality) Cost *are 'summed-up' by* Tri-Profit (n,n) (note: ***all*** costs in each context) Cost *is categorized using* Account (1,1)
Cardinality	3, n (The focal firm of a business model must have at least one environmental, social and financial cost metric in order to calculate its Tri-Profit)
Attributes	Name (Identifier) = All characters Description = All characters Unit Type = "Bio-Physical" | "Social" | "Monetary" | "Unit Less" [Current Value = <description> | <number> <units> <historic time period over which the flow of costs are summed, month, year, five years etc.>] (Optional only if SSBMO is describing a desired new business that does not currently exist) [Planned Value = <description> | <number> <units> <future time period over which flow of expected cost is summed, month, year, five years etc.>] (Optional only if SSBMO is describing a current business) [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]
References	(Osterwalder, 2004a, Table 39 pp.101-102) DDP5 DDP6, 4.6.5.2 (Blattberg, 2000)

Table 7-74: Cost

The Cost entity encourages the business model designer to consider the quantity of current or expected harm flow as agreed by the legitimated stakeholders over a given period of time and how this harm is generated by the firm's Offerings (and the Firm's Processes that deliver them via its Channel Links)

- How does the organization choose to measure the value of the costs incurred by your offerings?
- Do you measure cost in Financial terms (e.g. payments made to stakeholders, particularly suppliers), Social terms (e.g. decreased happiness, illness etc.), and / or Environmental terms (e.g. reduction in quantity or quality of bio-physical stocks or eco-system service flows) (Each in its own units)?
- How are cost metrics calculated by your valuation methods to measure value destroyed by each Offering (or Link)?

Unlike the BMO, which only conceptualizes a monetary Cost Structure element, the SSBMO includes a broad conception of Costs metrics as any measure of value destroyed over a period of time, e.g. an increase in toxicity, harm, inequity and / or opaqueness, etc.

The Cost:

- Description attribute gives the business model designer the opportunity to consider with the firm's legitimated stakeholders what the 'acceptable' or 'aspirational' definition of cost, how this is incurred, and how its calculation may be based on underlying environmental, social and financial process metrics.
- Unit Type and Units gives the opportunity for the business model designer to describe the nature of each Cost metric.
- Current and Planned Value attribute gives the business model designer the opportunity to record the current and planned values of the flow of Costs over a defined period.

- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for their Costs (as per DDP6). Location can be considered as part of the Social Context of a Cost metric (i.e. relative to the location of other human actors or a socially defined area, such as a specific place or country) or a constraint imposed by the Environmental Context of a Cost metric (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

7.4.6.8 Asset

Name	**Asset**
Definition	A metric of a stock of equity or liability at a point in time – environmentally, socially or monetarily – considered important to a firm's definition of success agreed by its legitimated stakeholders.
Related to (including cardinality of relationship)	Assets *occurs within the context of at least one part of* Environment (0,1), Society (0,1) and/or Financial Economy (0,1) (An Asset metric does not have to be related to the environment, but it must be related to at least one context, possibly more than one) Asset *occurs within the context of* Measurement Perspective (1,1) (i.e. Revenues are unique to a Firm) Asset *are measured using* Valuation Method (1,1) Asset *are inputs to* Valuation Method (0,n) (Note optionality) Asset *is categorized using* Account (1,1)
Cardinality	0, n
Attributes	Name (Identifier) = All characters Description = All characters Unit Type = "Bio-Physical" | "Social" | "Monetary" | "Unit Less" [Current Value = <description> | <number> <units> <historic point in time at which quantity of asset is recorded>] (Optional only if SSBMO is describing a desired new business that does not currently exist) [Planned Value = <description> | <number> <units> <future point in time at which desired quantity of asset is recorded>] (Optional only if SSBMO is describing a current business) [Location = <Geographical / Social Location / Area Label> | <Geo-spatial / Environmental Location / Area: { <Latitude> "," <Longitude> "," <Elevation> } >]
References	DDP5 DDP6, (Osterwalder, 2004a)**4.4.5.7**, 4.6.5.2 (Blattberg, 2000)

Table 7-75: Asset

The Asset entity encourages the business model designer to consider the quantity of current or desired stocks of capital as identified by the legitimated stakeholders at a point in time, and how these are accrued from a firm's Revenues (adding to assets) and decreased by a firm's Costs (adding to liabilities):

- How does the organization choose to measure the value of the stocks of assets required, created or depleted from your flows of costs and revenues?
- What stocks of each of the six types of capital are required, will be added to or depleted by the operation of your business model (natural, social, human, intellectual, manufactured and financial)?
- How do you measure assets in Financial terms (e.g. financial valuation), Social terms (e.g. social capital, relationship equity, knowledge capital, brand value), and / or Environmental terms (e.g. bio-physical stocks) (Each in its own units)?
- How are asset values calculated from your revenues or costs?

An asset is a measurement inherent to having privileged access to stock of something at a point in time. Business model designers should carefully compare this conception to costs and revenues, which are measures arising from a flow of value created or destroyed over a period of time.

The SSBMO conception of assets closes weaknesses in previous profit-first conceptions of a business model (4.4.5.7), since the BMO does not conceptualize assets. Further its broad environmental, social and monetary conception enables the modelling of all stocks of assets, capital, equity and liability, including ideas such as 'life-time value' of a customer or other stakeholder.

The Asset:

- Description attribute gives the business model designer the opportunity to consider with the firm's legitimated stakeholders what the 'acceptable' or 'aspirational' definition of each asset, how this is generated, and how its calculation is based on underlying environmental, social and financial revenue, cost and process metrics.
- Unit Type and Units gives the opportunity for the business model designer to describe the nature of each Asset metric.
- Current and Planned Value attribute gives the business model designer the opportunity to record the current and planned quantities of each stock of Assets at specific points in time.
- Location attribute gives the business model designer the opportunity to consider whether or not place is an important consideration for their Assets (as per DDP6). Location can be considered as part of the Social Context of an Asset metric (i.e. relative to the location of other human actors or a socially defined area, such as a specific place or country) or a constraint imposed by the Environmental Context of anAsset metric (i.e. an explicit latitude, longitude and elevation or geospatially defined area, such as a continent).

7.5 Strongly Sustainable Business Model Canvas

7.5.1 Introduction

The value of visual design tools, simplified visually attractive versions of ontologies that facilitate the evaluation and use of those ontologies, was introduced in 3.5.1.3.

The Strongly Sustainable Business Model Canvas (the SSBMC) is a simplified visually attractive tool conceptually ‘powered by’, and hence compatible with, the SSBMO (3.6.6). The SSBMC is a visual simplification of the SSBMO.

As shown in Figure 7-14, the SSBMC is ***not*** derived from Osterwalder’s visual simplification of the BMO, the Business Model Canvas (BMC) (Osterwalder & Pigneur, 2009; Osterwalder, 2010, 2011). Rather it is a visual simplification of the SSBMO.

As shown towards the right of figure, the SSBMC is derived from the textual capture (7.2-7.4) and diagrammatic coding of the SSBMO (both its formal detailed form, SM4 and its summary visual representation, SM3). This was achieved by applying the Canvas Design Principles (CDP1-3, developed during preparation activity group P4, 4.7.4) in light of a broad range of considerations from the literature (Chapters 3 and 4).

As also shown in Figure 7-14, the SSBMO was itself constructed by a design process that sought, with the overall research objectives and key theoretical frames in mind, to adhere to the overall and detailed design principles (ODP1 & 2, DDP1-6). In turn these were determined from the literature reviewed during the preparation activity stream (described in Chapters 1 thru 4), including a detailed critique and review of the BMO.

The visual representation for the SSBMC consists of a number of blocks in a specific arrangement (5.4.6).

Several variants of the SSBMC visual design tool representation, including help text (viewable by clicking on the large question marks that appear in the PDF file for SM5b), are included in the accompanying electronic files listed under the “List of Supplementary Materials” in the Front Matter of this thesis (SM5a-c).

The SSBMC is used to create comparator knowledge to help evaluate the SSBMO (Chapter 6). Comparator knowledge (K3 and K6-BM1-3) is created with instances of the SSBMO and SSBMC that describe:

- The Timberland Company (comparator knowledge K3, activity group E1c – 6.4.9.3, 6.5.4) for subsequent evaluation in activity groups E2a and E2b (6.4.9.4, 6.6) (See SM7).
- The case study companies (comparator knowledge K6-BM1-3) for subsequent evaluation in activity group E3 (6.4.9.5, 6.7).

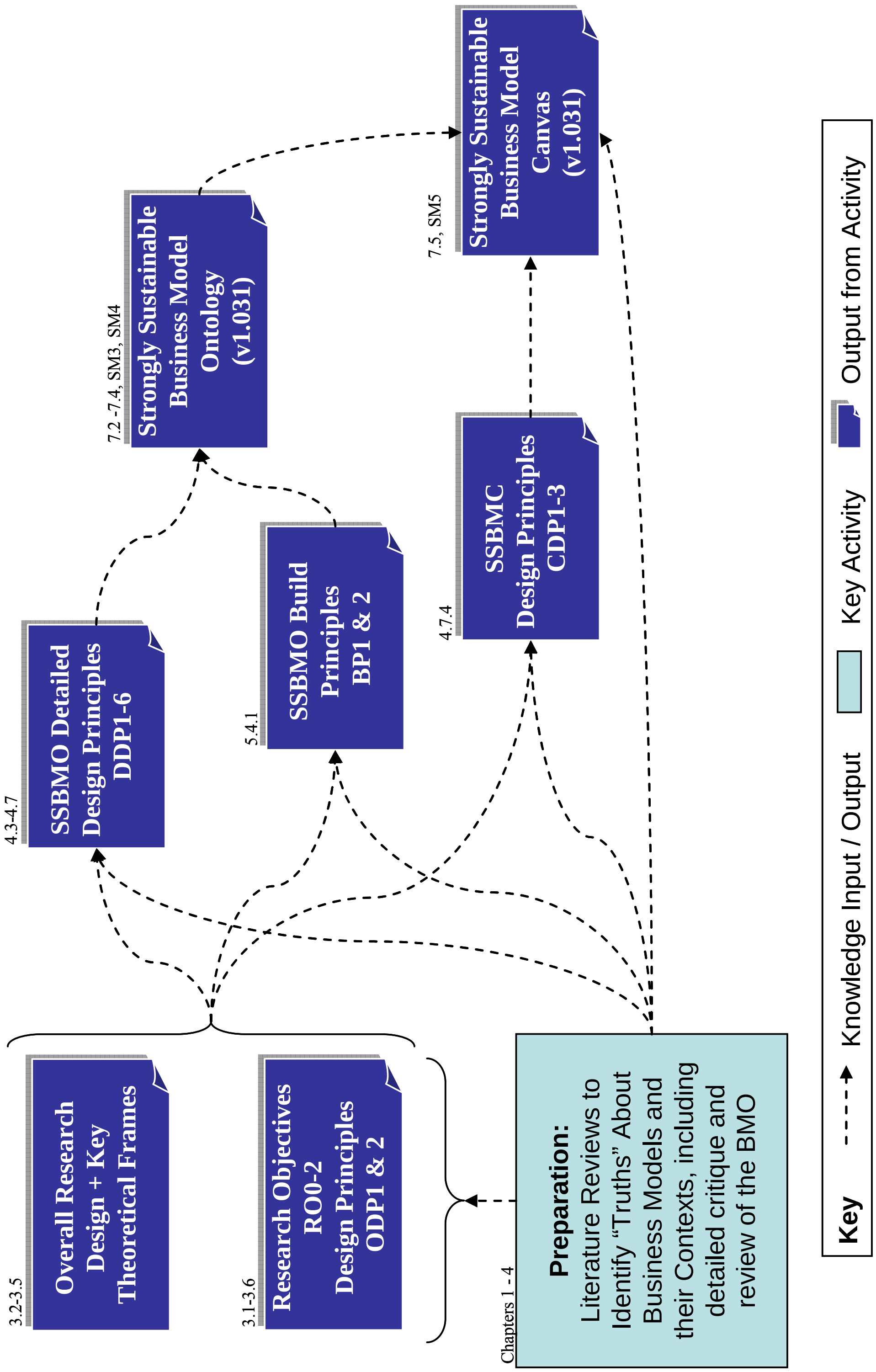

Figure 7-14: Derivation of the Strongly Sustainable Business Model Canvas

7.5.2 *Overview of Simplification*

Osterwalder identified pairs of related elements in his BMO, terming these "building blocks" (7.2.1.5). These building blocks became the only concepts included in the BMC. This approach to simplification was the inspiration for the process used to create of the SSBMC.

The starting point for the creation of the SSBMC was the summary visual representation of the SSBMO (SM3). As per 5.4.5, the summary representation of the SSBMO makes a number of simplifications to the SSBMO rendering a less involved view compared to the fully detailed formal diagrammatic representation (SM4).

Then each related pair of summary and detailed specific entities was examined (Table 7-21). Where advisable, based on the literature (Chapter 3 and 4), only one of each pair of entities was selected to be included in the SSBMC as a block representing the concepts related to ***both*** entities. All other SSBMO specific and generalized entities were then examined. Again, where advisable, based on the literature, a block representing related concepts was included in or omitted from in the SSBMC.

The selected blocks were then arranged to indicate, by spatially proximity, the most important relationships between the underlying concepts (formally coded and captured as relationships in the SSBMO).

'Help Text' for each of the blocks written derived from the description of each of the underlying entities and their interrelationships of the SSBMO (7.3 and 7.4). Finally an overview of the SSBMC was produced by further summarizing the selected blocks. In the overview some of these blocks are shown as 'Sticky Notes' with 'push pins'. Sticky notes shown with larger push pins and a darker band at the top of the stick note provide help related to each of the four perspectives. Sticky notes with smaller push pins provide help related to blocks within each perspective.

Table 7-76 shows from left to right how each of the SSBMC blocks and their subsequent summarization was derived from each of the SSBMO entities.

SSBMO		SSBMC	
Related Pair		Blank	Overview
Summary Specific Entity	**Related Detailed Specific Entity**	**Block**	**Post-It Note (with small pin) / [Block]**
Actor	Need	Actors	Actors and their Needs (Humans and non-Humans)
		Needs	
Target Stakeholder	Criterion	Stakeholders	omitted
Relationship	Function	Relationships	Relationships and the Channels through which they are maintained
Channel	Link	Channels	
Value Proposition	Offering	Value Propositions	Value Propositions (Positive and Negative)
Partnership	Agreement	Partnerships	Resources, Activities and Partnerships Required to Deliver Value Propositions
Capability	Resource	Resources	
Value Configuration	Activity	Activities	
16		8	4

SSBMC Other Specific Entity	Block	Post-It Note (with small pin) / [Block]
Firm	(Your) Organization	[Organization: Which organizations are in your value network (supply chain)?]
Decision	Decisions	Which Stakeholders Get to Make Decisions About What You Do and How You Do It
Bio-Physical Stock	Bio-Physical Stocks	Bio-Physical Stocks Transformed
Eco-System service	Eco-System Services	Eco-System Service Outputs Used
Valuation Method	Valuation Methods	Environmental, Social and Monetary Profit Calculation (Each in its own Units)
Tri-Profit	Tri-Profits	
Account	omitted	omitted
Process Metric	Processes	omitted
Revenue	Revenues	Environmental, Social and Monetary Measures of Costs, Revenues and Assets (Each in its own Units)
Cost	Costs	
Asset	Assets	
11	10	6

SSBMO	SSBMC	
Related Pair	**Blank**	**Overview**
Generalization Entity	**Block**	**Post-it Note (with large pin & dark coloured bar) / [Block]**
Context: Environment (Physical, Chemical, Biological)	As per SSBMO	As per SSBMO
Context: Society (Social / Technological)	As per SSBMO	As per SSBMO
Context: Financial Economy (Monetary)	As per SSBMO	As per SSBMO
Perspective: Stakeholder	Perspective: Stakeholder	[Perspective: Stakeholder, Everyone Involved with Your Organization]
Sub-Perspective: Firm Stakeholder	omitted[108]	omitted
Perspective: Product, Learning & Development	Perspective: Product, Learning & Development	[Perspective: Product, Learning & Development, What Your Stakeholders Receive from the Organization]
Perspective: Process	Perspective: Process	[Perspective: Process, How Your Organization Creates and Delivers Value Propositions]
Sub-Perspective: Firm Process	omitted	omitted
Perspective: Measurement	Perspective: Measurement	[Perspective: Measurement How Your Organization Defines Success and How is It Measured]
9	7	6
36	25	17 (13 Post-It Notes + Organization Block + 3 Context & 4 Perspective Blocks)

Table 7-76: Derivation of SSBMC Blocks from SSBMO Entities

7.5.3 Reflection on Utility Possibly Enabled by the SSBMC

In 7.2.1.3 “Reflection on Overall Rationale for Changes to the BMO” a challenge for the design of the SSBMO was described: its conceptual complexity (and hence the necessary complexity of its representations). Four possible implications of this complexity were suggested, of which the second and third were seen to be resolvable by the design of the SSBMO and SSBMC and their visual representations.

[108] Conceptually represented by visual position of Organization block in relationship to other Blocks, as per positioning of firm boundary entity in summary visual representation of SSBMO (SM3, 5.4.5).

The BMC visual tool, through its design, managed to simplify the 33 constructs and 44 relationships of the BMO to 9 blocks and their spatial relationships. Similarly, the SSBMC visual tool, has managed to simplify the 36 constructs and 191 relationships of the SSBMO to 13 post-it notes, 1 specific block, 3 context blocks and 4 perspective blocks and their spatial relationships (from Table 7-5).

Hence, while the BMC can be considered to pose 9 broad questions to any profit-first business model designer, the SSBMC can be thought of as posing 14 broad questions to any strongly sustainable business model designer (13 post-it notes and 1 organization block; the other blocks being context for all the questions rather than posing any of their own).

This ability to simplify the SSBMO to such a degree suggests that perhaps the SSBMC has managed to adopt design choices that at least partially avoid the implications of its undeniable but required underlying complexity.

Perhaps this simplification may enable a strongly sustainable business model designer to change focus, ignoring now irrelevant complications that appeared in the BMO? Hence perhaps the net cognitive load in using the SSBMO and the SSBMC it powers remains unchanged compared to the BMO and the BMC it powers. These are propositions that the evaluation activities will gather data in order to form an initial response (7.2.1.3).

7.6 Summary of Differences Between SSBMC and BMC

As part of the evaluation activities a number of respondents already familiar with the BMC requested a written summary of the differences between the SSBMC and BMC.

While there is no direct conceptual or visual connection between the BMC and SSBMC (as shown by Figure 7-14) such a summary was prepared as Working Paper #2 (available upon request).

7.7 Proto-Strongly Sustainable Business Design Principles

While strictly speaking outside of the defined scope of the research (L7, 2.6), to assist Business Model Designers, as introduced in 4.7.2.6, this section provides what might be considered *proto*-Strongly Sustainable *Business* Design Principles (pBDP). These are derived from the same literature used to derive the ontology Overall and Detailed Design Principles (Chapters 1 thru 4).

Others have proposed sustainable business (model) design principles, but without making their theoretical basis clear (Bansal, 2011; Hutchins, 2012b; Willard, 2010a).

Labelling these as proto-principles should be taken to mean that while they are very likely, based on the literature, to be necessary, they are unlikely to be neither sufficient nor expressed in the most efficient or clear manner. Further, there are likely variations in scale, with considerable overlaps and gaps amongst them. See proposed research agenda for more discussion on the possible approach to close this theoretical gap and subsequently justify these principles (Chapter 11).

Each pBDP is primarily aligned with one of the fives parts of the argument made in 4.7.2 "Towards a Theory for the Conditions Required for Strongly Sustainable Organizations (TSSO0-5)". Each pBDP attempts to take a part of this argument and re-express it as a design principle supported by the evidence from the same literature.

Business model designers who attempt the vey challenging intellectual and emotional work of adhering to these principles when responding to the questions posed by the entities and inter-relationships within the SSBMO, might be expected to create business model designs that are more likely to enable strongly sustainable outcomes.

Such business model designers are to be empathetically commended and supported for any such efforts and attempts.

7.7.1 TSSO0: Over-Arching Design Principles

The following pBDPs might be considered by business model designers as being applicable at all levels of scale of design and irrespective of which other principles might be valid.

pBDP0a: Be Clear About Definitions

Whenever the term sustainable or resilient is being used to describe a desired state, be certain to understand:

1. What is the thing or process to be sustained or made resilient?
2. On whose behalf, who benefits, from such a desired state?
3. For how long must the desired state be maintained?
4. Is the cost of achieving and maintaining the desired state acceptable?

   (See 4.4.3.2, adapted from Allen, 2003, p.26)

pBDP0b: Stay Within Overall Limits

Any organization may only attempt to create conditions in which resilient sustainable outcomes may emerge via one or more of these three avenues:

1. Simplifying to a level commensurate with available energy.
2. Finding more energy to subsidized increase elaboration (of complexity or complicatedness).
3. Using energy supplies as efficiently and effectively as possible.

   (Summarized from Allen, 2003, p.391)

pBDP0c: Design Management Systems as an Ecologist Would

Within the overall limits, outcomes will be more effectively and efficiently created if solutions are designed based on ecological thinking, i.e.

- *Manage for productive systems rather than for their outputs*
- *Manage systems by managing their contexts*
- *Identify what dysfunctional systems lack and supply only that*
- *Deploy ecological processes to subsidize management efforts rather than conversely*
- *Problem solve with the knowledge that returns diminish over time as previous elaboration increases costs relative to benefits of future solutions at the same level of complicatedness.*

(Allen et al., 1999, p.14)

The "Principles of Life" from the field of biomimicry should also be considered (Bansal, 2011; Benyus, 2002; Blend, 2007; Dargent, 2011; Hutchins, 2012a; Hutchins, 2012b; Hutchins, 2012c; Laughland & Bansal, 2011; Upward, McDougall, & Hoeller, 2012)[109].

pBDP0d: Choose Designs That Bias Continual Improvement Towards a Stated Vision

Designs that are clearly way-points on a journey towards a vision of a strongly sustainable organization (society and planet) are necessarily developed using back-casting (Holmberg & Robèrt, 2000; Robinson, 1990; Robinson, 2003). Such designs provide

- Benefits aligned with the organization's aspirational goals.
- An increase inthe organization's sustainable maturity level over time (7.7.8)

[109] Also see various website devoted to Bioinspired Design.

Such designs will enable the Framework for Strategic Sustainable Developments "three prioritizing questions to be answered in the affirmative" (Holmberg & Robèrt, 2000), i.e does each design choice:

1. Move us in the right direction with regards to our planetary conditions for strong sustainability (7.7.2)?
2. Provide a flexible platform, i.e. a stepping stone towards future improvements
3. Provide an adequate return on the environmental, social and monetary investment (use of capital) to seed future investments?

pBDP0e: Follow Business Design Principles from Recognized Strongly Sustainable Leaders and Their Frameworks

A number of business oriented organization have issued (at varying levels of detail) specific advice on how to organize and operate all aspects of a sustainable business. Leaders identified by this research include:

- Natural Logic's Sustainable Business: A Declaration of Leadership (Friend, 2005)
- The Business Alliance for Local Living Economies (BALLE) Localist Values[110]
- Institute for Local Self-Reliance Initiative for Independent Business[111]
- Transition Network / Transition Towns Handbook (Hopkins, 2008)
- Local exchange trading systems

[110] (Business Alliance for Local Living Economies (BALLE), 2012)
[111] (Intitute for Local Self Reliance (ILSR), 2012)

pBDP0f: Reverse Engineer Design Principles from Leading Strongly Sustainable Standards for Business

Standards for Strongly Sustainable Organizations, i.e. a collection of threshold measurements for a set of metrics for strongly sustainable organizations (as defined in Table 7-66), may be 'reverse engineered' to discover the underlying design principles that must be followed so the resulting business reaches or exceeds each threshold[112].

For a list of some of the leading standards see 7.7.7.

Other standards that may be helpful can be found in "Design is the Problem: the Future of Design must be Sustainable" (Shedroff & Lovins, 2009).

7.7.2 TSSO1: Definition of Planetary Conditions for Strong Sustainability

pBDP1: Ensure Design Meets Planetary Conditions for Strong Sustainability

Two approaches to defining the planetary conditions for strongly sustainable outcomes to reliably emerge have been identified. Business model designs must remain within these planetary conditions.

[112] This approach was not taken in the development of the SSBMO ODP and DDP since the B Lab B Impact Survey knowledge source was used as a source of comparator knowledge (K2) during evaluation activity group E1.

First: The Alliance for Strategic Sustainable Development's[113] Framework for Strategic Sustainable Development's four Sustainability Principles or Systems Conditions for Sustainability (4.4.3.2 "Sustainability" and 4.6.4) states the 'upper limit' for organizational behaviours related to the bio-physical and social:

> Through its behaviours and the behaviours of all other relevant social, economic and biophysical actors a sustainable organization does not subject nature to systemically increasing:
>
> 1. Concentrations of substances extracted from the earth's crust – nothing disappears – ever
> 2. Concentrations of substances produced by society – everything spreads everywhere
> 3. Degradation by physical means – existing structure creates significant value
>
>   and
> 4. Further, none of these behaviours creates conditions that systematically undermine any human or other life's capacity to meet their needs.
>
> (Eriksson & Robèrt, 1991; Holmberg, Robèrt, & Eriksson, 1996; Tippett, 2001)

Second: The Planetary Sub-System Boundaries suggest bio-physical behaviour boundaries for society in scientific units (See Table 4-4 adapted with minor changes from Rockström & et. al., 2009; Rockström, 2009).

[113] http://www.alliance-ssd.org/

7.7.3 TSSO2: Personal World-View Compatible with our Scientific Knowledge of Strong Sustainability

pBDP2: Design from a World-View Compatible with our Knowledge of Strong Sustainable

Designers should

- Adopt a world-view that holds the "Natural Laws of Sustainability" (Table 4-13: Doppelt, 2012, Box 1 p.147) to be true and without controversy (4.6.3.3).
- Make all design choices in alignment with these laws.

7.7.4 TSSO3: Macro-Socio-Economic Goals Compatible with Understanding Strong Sustainability

pBDP3: Constrain Design Based on Macro-Socio-Economic Goals

Designers should constrain their business model designs based on the following three policies, irrespective of whether these are formally in place in the relevant jurisdictions or not.

- Policy #1: Limit the ***absolute*** flow of all bio-physical materials through the business model (i.e. the focal firm, its value system / network partners, i.e. all the firm's stakeholders).
- Policy #2: Do everything possible to maximize distributional equity of environmental, social and monetary flows of benefits amongst all the firm's stakeholders.
- Policy #3: Within the limits imposed by Polices #1 and #2, using the market and market pricing mechanisms to achieve organizational environmental, social and monetary efficiency and effectiveness.

(Adapted from: Lawn, 2001)

7.7.5 TSSO4: Organizational Goals Compatible with Understanding Strong Sustainability

pBDP4a: Choose an Organization Definition of 'Acceptable Success' Compatible with Enabling the most Strong Sustainability Outcomes

An organization's stakeholders should explicitly define its acceptable level of success in such a way such that it is compatible with the following statements:

> Our organization is one in which:
>
> - All of its behaviours and all the behaviours of all other relevant social, economic and biophysical actors, lead to the possibility that human and other life will flourish on the planet forever.
>
> We achieve this by maximizing:
>
> - The quantity of the needs of human and other life that are met via satisfiers that align with the recipient's world-views (i.e. maximizing value creation)
>
> and minimizing:
>
> - The withdrawal of satisfiers, the application of inappropriate (pseudo) satisfiers, or the application of satisfiers that do not align with the recipient's world-view (i.e. minimizing value destruction)
>
> So that the total net result satisfices greatest amount of environmental, social and monetary benefit for as much human and other life as possible.

These statements are derived from this thesis's working definitions of:

- The Strongly Sustainable Organization (3.5.3.4)
- Value, Value Creation and Value Destruction (4.4.3.5)
- Tri-Profit (7.4.6.1, 7.4.6.3)

pBDP4b Explicitly Set-out Businesses Design Goals and Assumptions

An organizations' stakeholders should explicitly choose design goals and assumptions for their organization in such a way such that they are compatible with the following statements:

Our system of production reliably creates the possibility for:

- Abundance, not limits
- Everyone and everything forever, not just me now
- Flourishing by being, not languishing by having
- Positively contributing, not doing less damage
- Enduring, not failing
- Happiness, not fear
- Confidence, not uncertainty and distrust

and in so doing:

- Creates a net increases in well-being, natural and human capitals, e.g.
  - Our buildings: 'produce' more than they 'consume' while increasing the purity of air, soil and water
  - Using our products and services increase well-being and contribute to eco-system service flourishing and the quality and quantity of bio-physical stocks
  - At end-of-life, our products are 100% bio-degradable (for biological nutrients) or are 100% reused at the same or higher level of utility (for technical nutrients)

These are derived from the works of McDounough, Braungart and others first introduced in 4.6.3.3, Table 4-13 (Blend, 2007; Summarized from Ehrenfeld, 2008; and McDonough & Braungart, 2002, p.18, ch.2 pp.45-67 & pp.89-91; Young & Tilley, 2006).

7.7.6 TSSO5: Business Model Designs Compatible with Understanding Strong Sustainability

For a number of the entities within the SSBMO there are specific bodies of theoretical knowledge, practices and patterns which are known to increase the likelihood for strongly sustainable outcomes to emerge.

It is hoped over time that such bodies and knowledge will exist for all entities within the SSBMO.

pBDP5a:Actors and Stakeholder

Follow the advice concerning actors, stakeholders and actor's needs derived from theory developed by Max-Neef (4.4.3.4, 4,5,3,4), Hart (4.5.5.8 Social Impact), and positive psychology (4.4.3.2 Flourishing)

pBDP5b: Governance and Decisions

Follow the advice concerning governance and decision making, particularly in regard to resources which are shared by many human and non-human stakeholders, by Ostrom (4.6.5.4, Table 4-16).

Carefully consider how an organization, as a member of an extended value network can most effectively 'play their part' in generated preferred systems outcomes. Choose solutions which maximize these possibilities.

Concepts from participatory democracy and the design of inquiring systems would also appear to be applicable.

pBDP5c: Process

There is increasing advice on design of 'top-level' (7.4.5.9) business processes to be strongly sustainable, e.g. "cradle-to-cradle", 'closed-loop' or 'circular' process design (McDonough & Braungart, 1998; McDonough & Braungart, 2002; Stahel, 1994; Stahel, 1998).

While there is a dearth of advice on designing the more detailed aspects of a process ("Sub-processes", "Tasks", "Practices" 7.4.5.9) so that the detailed operation and outcomes enable strong sustainability (Upward, 2009), there is increasing advice on

- Designing partnerships (Pagell & Gobeli, 2009; Pagell & Wu, 2009; Pagell, Wu, & Wasserman, 2010),
- Increasing effectiveness of energy and resource use (Anastas, 1998; Lovins, 2011; Weizsäcker, 2009) and the
- Overall design of the socio-technical systems underlying all business processes (Trist, 1981b).

The latter work, for example, identifies principles of job design which would yield high quality productivity for organizations while simultaneously providing employees with satisfying jobs, ones in which individuals could flourish. (Table 4-19 from: Trist, 1981a, Table 2-1 p.30).

7.7.7 Standards for Strongly Sustainable Business Measurement

A number of organizations have and are actively developing strongly sustainable organizational standards for the measurement of organizational performance. As noted in pBDP0f these may be reverse engineered to reveal important underlying design principles (7.7.1).

A number of business oriented organization have issued (at varying levels of detail) applicable measurement standards which appear to be aligned with the literature on strongly sustainable organizations reviewed. Leaders identified[114] in this research include:

- ()Comparison International's PROmoting Business Excellence (PROBE, developed with The Natural Step)[115]

[114] Dr. Bob Willard's on-going work, as part of a global multi-organization effort to create a "gold standard for organizational sustainability", to identify and categorize all known standards was most helpful (The Natural Step, 2013). The forthcoming Global Initiative for Sustainability Ratings (GISR) and the related standards, current under development, may soon be added to this list.

- The Benefit Impact Reporting System (BIRS) and the Global Impact Investment Rating System (GIIRS)[116], developed by B Lab and used in evaluation activity stream E1 of this research) (B Lab, 2010a).

See proposed research agenda for more discussion on the possible approach to close this theoretical gap (Chapter 11).

7.7.8 Maturity Model for Strongly Sustainable Business

The efficiency-substitution-redesign (ESR) framework (Hill & MacRae, 1996) can be described as a maturity model of organizational sustainability[117]. Efficiency and substitution levels of this model of organizational change do not employ double-loop-learning to question underlying assumptions, and hence are highly likely to only lead to less unsustainable outcomes rather than the learning required to achieve proactively sustainable ones (M. K. Smith, 2001).

However, overall there is a limited amount of knowledge on the stages of maturity through which an organization may traverse on its way to only enabling strongly sustainable outcomes (Doig, 2003; Doig, 2009; Willard, 2012, Fig 1.15 pp.20-21).

None of the measurement standards for strongly sustainable organizations connect their results to any of the maturity models at this time.

It is hoped over time that such models will be enhanced and be subjected to empirical scrutiny, so that business model designers may use them when attempting to adhere to pBDP0d: Choose Designs That Bias Continuous Improvement Towards a Stated Vision (7.7.1).

See proposed research agenda for more discussion on the possible approach to close this theoretical gap (Chapter 11).

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[115] http://www.comparisonintl.com
[116] http://giirs.org/
[117] Personal communication with Prof. Rod MacRae.

7.8 Coding and Capture Inconsistencies of the BMO

As per Gap #13 (Table 7-2: BMO Gap Analysis and Proposed Resolution Design) this section lists the

- Coding and capture inconsistencies found in the BMO in constructing SM2, the detailed, formal diagrammatic representation of the BMO (7.2.1.2).
- The chosen resolutions to these inconsistencies in the SSBMO.

The relationship between the Criterion and Mechanism elements is shown in a summary diagram (Osterwalder, 2004a, Fig.21 p.44) – but not described in text nor shown in the related detailed diagram (Fig. 31 p.61). This relationship is included in the SSBMO.

The relationship between the Partnership and Capability elements is shown in summary diagram (Fig.21 p.44) – but not described in text nor shown in the related detailed diagram (Fig. 48 pp.89-95). Since the detailed entities related to Partnership and Capability (Agreement and Resource) are both related, this relationship is omitted from the SSBMO.

The relationship between the Partnership and Value Configuration elements is shown on the detailed design and described in the text (Fig. 48 pp.89-95), but is not shown on the summary level diagram (Fig.21 p.44). This relationship is included in the SSBMO.

There is some general sense that:

- The Revenue Model element should be related to the Target Customer element.
- The Revenue Stream and Pricing element should be connected to Criterion element.

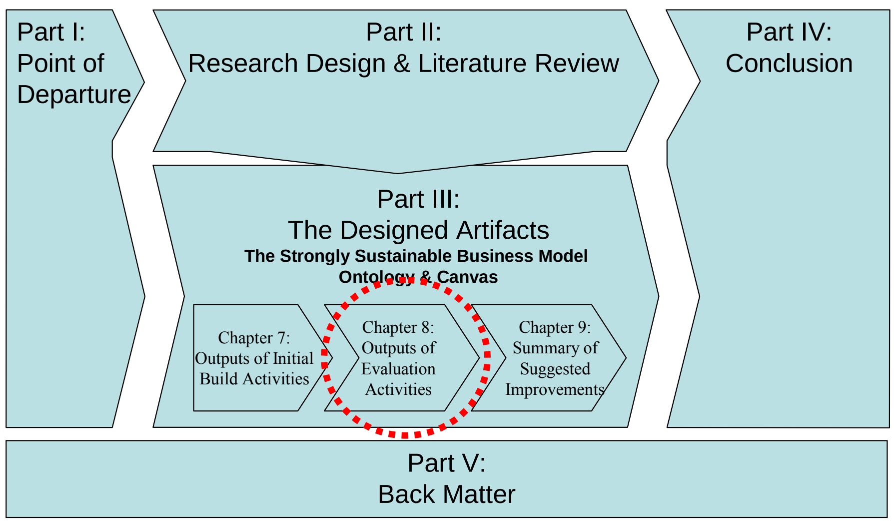
However, neither of these relationships is well described in the text, nor shown on any detailed diagram. These relationships are omitted from the SSBMO.

Chapter Eight: Outputs of Evaluation Activities

I believe in evidence. I believe in observation, measurement, and reasoning, confirmed by independent observers. I'll believe anything, no matter how wild and ridiculous, if there is evidence for it. The wilder and more ridiculous something is, however, the firmer and more solid the evidence will have to be — Isaac Asimov

Those who think 'Science is Measurement' should search Darwin's works for numbers and equations — David Hunter Hubel

The first steps in the path of discovery, and the first approximate measures, are those which add most to the existing knowledge of mankind — Charles Babbage



This chapter describes the output from the evaluation activity stream of this research. This chapter uses the detailed research design described in Chapter 6, which embeds the steps set-out at the start of Part II. The evaluation activities were executed iteratively with the build activities, as per the second build activity stream principle (BP2, Chapter 5). The results of the search (A) undertaken by evaluation activity groups E1-3 that results in the availability of the relevant comparator knowledge sources (K1-6) is presented. Next results of evaluation activity group E4 are presented: a reflection (B) that applies (C) a synthesis and analysis of the feedback arising from the evaluation of the artefacts (K0) against the comparator knowledge sources (K1-K6). This results in the determination of values for the metrics of research rigour and utility (M1-11) and identifies gaps in artefact utility (GU1-11) and where observed gaps in research rigor (GR1-11).

8.1 Introduction

This overall research question (RQ) for this research is:

RQ: Is it possible to design an ontology that can be usefully employed to describe a firm's strongly sustainable business model design?

In other words, as stated by the Research Objective (RO), this research seeks to design an artefact with the highest utility; one that provides the best answer to the Research Question. Section 2.2 introduced and section 3.6.6 showed how high utility can be understood as a combination of maximizing:

- Research rigour (RO0)
- Artefact quality: consisting of reliability (RO1a), consistency (RO1b), and effectiveness (RO1c) and
- Efficiency of artefact use (RO2).

Subsequently the research question was refined into two aspects (introduced in 3.5.3.4, summarized in 3.6.6):

RQa: How can strong sustainability emerge as an outcome of an organization understood as a multi-minded ideal-seeking purposeful system (analysis), and what systems contain / provide context for an organization so understood (synthesis)?

RQb: How can such an understanding be modelled using an ontology in order to enable a tool useful for managers attempting to design the conditions from which strongly sustainable outcomes may emerge from and for their organizations?

RQa was answered through the literature review of the key theoretical frames (K0) and the derivation of the Overall and Detailed Design Principles (ODP1 & 2, DDP1 thru 6), undertaken during the preparation activity stream (described in Chapter 4).

Chapter 7 started to answer RQb by describing the SSBMO and SSBMC artefacts that, based on the design principles, ought to have high utility. The artefacts should have high utility, since the design principles were derived from the literature. Of course this assumes the key theoretical frames were legitimately identified (Chapter 3) and that the associated literature contained useful truths (summarized in 4.3-4.7).

However, even making this assumption, the utility of the artefacts could be compromised by weaknesses in the:

- Derivation of the design principles from the literature
- Design of the artefacts (failure to adhere to the design principles or failure in their capture, coding and expression).

Hence, this chapter completes the answer to RQb, by describing whether managers found the artefacts useful or not; i.e. whether these assumptions were valid and whether potential weaknesses did in fact occur. Any weaknesses found are described by the gaps between found and the desired high level of utility. Gaps may concern the utility of the artefacts (labelled GU1-11), or if they are apparent, gaps in the rigor of the research design (labelled GR1-11). This aspect of the evaluation research design is described in 6.8.

Chapter 9 then discusses what might be done to improve the artefacts to address any weaknesses found by identifying candidates for improvement in utility and rigor.

8.1.1 Chapter Structure

This chapter is structured as follows:

- Section 8.2 introduces the evaluation results by summarizing key points of Chapter 6, the detailed research design for the evaluation activity stream.

- Section 8.3 compares the evaluation activity stream research design to the evaluation activities actually undertaken.
- Sections 8.4 thru 8.8 describe the results of each of the evaluation activity groups (E1a-c, E2a-b, and E3), the determination of the values of the metrics measured by each group, and the identification of gaps between desired and actual utility and research design rigor:
  - Section 8.4 presents the results of determining the measurement context, undertaken in Preparation activity group P6.
  - Section 8.5 presents the results of the comparative analysis evaluation activity group (E1) and the subsequent determination of metric values and the identification of gaps (E4)
  - Section 8.6 presents the results of the informal third party review (E2a), the subsequent determination of metric values and the identification of gaps.
  - Section 8.7 presents the results of the formal third-party expert reviews (E2b), the subsequent determination of metric values and the identification of gaps.
  - Section 8.8 presents the results of the case studies (E3), the subsequent determination of metric values and the identification of gaps.
- Section 8.9 and 8.10 completes the reporting on evaluation activity group E4, by comparing the results described in the sections 8.4 thru 8.8 with the overall Research Question (RQ, RQa & RQb), Research Objective (RO0, 1 & 2) and Working Hypotheses (WH1-4). Values of the metrics are examined this light, and additional gaps in artefact utility and research rigour are identified, including the presentation of the final values of each of the metrics (M1-11).
- Section 8.11 reflects on the use of the research design and the identification of gaps between desired and actual rigor (E4).

8.2 Overview

As summarized in Table 8-1, Chapter 6 identified a number of aspects of utility, mapped these to the research objectives, and defined metrics whose values would provide feedback on artefact utility (confirmatory and opportunities for improvement).

Research Objective		Aspect of Utility	Metrics	
RO0	Rigor	Context	Expectation	M1
			Desirability	M2
			Importance	M3
RO1a	Reliability	Completeness	Completeness (reliable)	M4a
			Level of Detail	M5
		Quality	Comprehensibility (reliable)	M6a
			Real-world Likeness	M7
RO1b	Consistency	Quality	Internally consistent	M8
RO1c	Effectiveness	Generic	Useful to user	M9
		Beauty	Elegance (technical, aesthetic)	M10
RO2	Efficiency	Completeness	Completeness (efficiency)	M4b
		Quality	Comprehensibility (efficiency)	M6b
			Easy to use	M11

Table 8-1: Evaluation Metrics for each SSBMO Research Objective
(Summary of Tables 6-22 and 6-23, updated in light of findings below)

The values of metrics M1 thru M3, which set the overall context for the capture of values for all the other metrics were determined during Preparation activity group P6, and initially set-out in Table 6-20. These results are formally presented in 8.4.

The content for the remainder of this chapter is the result of the analysis and synthesis of the comparator knowledge sources (K1-K6), introduced in Chapter 6 (6.4), created during evaluation activities E1-E3 (6.5-6.7), and undertaken during evaluation activity group E4 (6.8).

The creation of the comparator knowledge sources required a number of intermediate documents, including: research logs, presentation materials describing the artefacts and their construction, documents received from case study respondents, interview notes, recordings and associated transcripts, and finally the Nvivo qualitative analysis software database. The materials used to construct the comparator knowledge sources are available upon request.

The comparator knowledge sources constructed during each evaluation activity group, as summarized in Figure 6-4 and Table 6-25, are presented and / or summarized in sections 8.5 thru 8.8 (subject to confidentiality requirements). One of the comparator knowledge sources, Timberland's Business Model (K3-BM) is included in the electronic Supplementary Materials described in the Front Matter of this thesis (SM6 and SM7). Where omitted, for reasons of confidentiality, the detailed and any summaries of the comparator knowledge sources are available for inspection.

Evaluation activity group E4, as described in 6.8, evaluated the artefacts (K0) against the comparator knowledge sources (K1-6) using synthesis and analysis to:

- Determine values of each of the metrics applicable to each of the evaluation activity groups (M1-M11).
- Identify gaps between desired and achieved artefact utility (GU1-11).
- Where observed, identify gaps between the desired (RO0) and achieved research rigor (GR1-11)

Values of metrics were determined using the techniques identified in Table 6-25. In summary, the values of metrics related to evaluation activity groups:

- E1 and E2a were, by definition (6.4.9.3-4), synthesized by the researcher.
- E2b and E3 were determined from interview recordings, transcripts and notes through analysis and synthesis using the Nvivo qualitative analysis software (6.8).

8.3 Comparison of Evaluation Research Design Created vs. Executed

The evaluation research design was executed as described in Chapter 6, with the exceptions described below. This can be compared to the difficulties and risks identified prior to the detailed design of the research methods (R1-4, 3.6.10), and might be considered manifestations of these risks during the execution of the research design.

1. The CATWOE evaluation technique (the basis for comparative evaluation activity group E1a, and the technique used as a part of evaluation activity groups E1c and E3) was not undertaken (6.5.2, 6.5.4.6. and 6.7.1.7 respectively).

   In practice, upon critical reflection, it was found that the researcher did not have sufficient distance from the artefacts to use the CATWOE technique to generate valid values of the feedback metrics.

2. Only two of the three cases were undertaken (E3a and E3b). Case E3c was not undertaken. This was primarily due to lack of researcher time and effort, and secondarily due to the difficulty encountered in locating a strongly profit-first case study firm able to take the time to participate (6.7.1.5).

3. Nine additional opportunities to informally gather feedback from 3rd parties was undertaken, compared to the one opportunity expected (E2a, 6.6.1, 8.6.2.3).

4. The opportunity to undertake a number of other activities from which has arisen considerable evidence of face validity of both the research problem and the solutions proposed by the designed artefacts, albeit outside the controlled conditions of the evaluation activity groups E1-E4 (8.6.2.4).

As discussed below, the first two exceptions are not felt to materially impact the results of this research. However, their omission does lead to the identification of gaps in research rigor (GR2 and GR1 respectively) and hence an opportunity for improvement. The third and fourth exception actively generated additional face validity for the overall utility of the SSBMO, particularly in a design mode. This is reflected in the final values of metrics M9 and M11 (Table 8-7 and Table 8-14).

8.4 Result of Measurement Context (P6)

8.4.1 Introduction

The values of metrics M1 thru M3, set the overall context for the capture of values for all the other metrics.

This was necessary, as per the methodological literature reviewed, in order to ensure rigor: explicitly setting context prior to undertaking all the build and evaluation activities (6.2.7.4, 6.4.4).

These values were determined based on the assessment of the researchers context (determined during preparation activity group P6, and initially set-out in Table 6-20) and a post-hoc assessment of all the participant's approach to their participation.

8.4.2 Results

Table 8-2 presents the final values of the three metrics related to evaluation context.

Metric		Value
M1	Expectation	The expectation was high that the SSBMO is highly useful: the result of the inquiry suggested by the research question is expected to be useful.
M2	Desirability	The desirability of a highly useful SSBMO was high: the problem set out in the research objective is desired to be improved.
M3	Importance	The importance of a highly useful SSBMO was high: a highly useful solution to the problem set out in the research objective is considered to be important.

Table 8-2: Value of Metrics of Evaluation Context (M1-3)

At no time did the researcher, nor any of the participants, indicate anything other than a neutral or positive expectation of the desirability and importance of a SSBMO with high utility. This was even true of those participants who stated they had a world-view closer to the profit-first than strongly sustainable stance.

This can be ascribed, at least in part, to the high degree of rigor used to undertake this research and the high degree of face validity of the key antecedent, the BMO:

- "The methodology that you used, the level of research that you've done is extraordinary" (Respondent E2b-2).
- "It's about time somebody did something like this. And you're being extremely rigorous. I think you've really thought about it" (Respondent E2b-5).
- "[The research] process is fine. You're very, very diligent about making sure your research is not contaminated and all that sort of thing. So yeah, the process if fine. It was fun. It's good" (Respondent E3a).

Support for these assertions is presented through an analysis of the responses to the demographic items (E2b-Q-DG-1-8 and E3-Q-DG-1-7) in sections 8.7.2 and 8.8.2 respectively.

8.4.3 Gaps

In setting the context for determining the values of the other metrics, M1 thru M3 are not intended to confirm nor gather feedback on gaps in artefact utility.

However, the determined values of these metrics do highlight one gap in research rigor:

GR1: Despite attempts, no feedback was gathered from persons with world-views that create any combination of low expectation of SSBMO utility, low desirability of that utility and low belief in the importance of that utility (6.4.6.2).

8.5 Result of Comparative Analysis (E1 & E4)

8.5.1 Results of Comparative Analysis Using the CATWOE Knowledge Source (K1, E1a & E4)

The detailed research design of this evaluation group is introduced in 6.4.9.1-3 and set out in detail in 6.5.2. The intention was to determine values for metrics M4 (Completeness), M5

(Satisfactory Level of Detail) and M8 (Internal Consistency), and to report on evaluation hypothesis E1a-EH1 and E1a-EH2.

As noted in 8.3, this evaluation activity was not undertaken. In the SSM approach to problem solving the CATWOE technique is intended to be used to validate the root definitions from the perspective of the participants multiple world-views. Each of the elements of the CATWOE framework enables each participants to reflect on a different aspect of the root definitions. This evaluation, from multiple world-views, then provides additional feedback from which a useful conceptual model of the focal human activity system may then (probably iteratively) be developed (Smyth & Checkland, 1976). It was envisaged during the design of the research that such an analysis could be usefully done on the constructs and relationships within the SSBMO to confirm their validity (M4-5, M8).

In hindsight it was realized that the potential biases identified during the design process (6.5.2.3) were in fact so large and the risks identified so manifest (R1-4 3.6.10) as to invalidate any results generated by this technique. The researcher had constructed a model of validity that justified the inclusion of each of the constructs and relationships in the SSBMO. Hence, it seemed unlikely that this model might be meaningfully confirmed or that opportunities to improve might be reliably and transparently identified by the same researcher.

Hence the following gap in research rigor is highlighted:

GR2: For useful values of these metrics to be gathered using the CATWOE technique in design science research requires the involvement of 3rd parties unrelated to the artefacts or the process of their creation.

8.5.2 Results of Comparative Analysis Using the B Lab Impact Assessment v3 Knowledge Source (K2, E1b & E4)

8.5.2.1 Introduction

The detailed research design for this evaluation group is introduced in 6.4.9.1-3 and set out in detail in 6.5.3. The intention is to determine values for metrics M4 (Completeness), M5

(Satisfactory Level of Detail) and M8 (Internal Consistency), and to report on evaluation hypothesis E1b-EH1-4.

8.5.2.2 Results

Based on the scoring scheme set out in Table 6-30, Table 8-3 sets out comparator knowledge source K2; the result of this comparative analysis. In this analysis higher scores indicate higher artefact utility at representing the concepts required to respond positively to the 106 items in the B Lab Impact Assessment v3 survey.

Result	BMO	SSBMO
Raw Score (Out of 530, 5 * 106)[1]	196	507
Average Score	1.85	4.78
Median Score	2	5
% age of Median Value Scores	53%	79%
Count of scores of		
– 1 (concepts very difficult to represent)	36	0
– 2 (concepts difficult to represent)	56	0
% of Items with Difficult or Very Difficult Scores	87%	0%
Maximum Score	5	5
% of Items with Maximum Value Scores	2%	79%
Number of 0 / N/A Responses	1	1

Table 8-3: Raw Scores from Comparative Analysis Activity – B Lab (E1b, M4-5, M8)

Analysing these results against the expected, desirable and importance of a highly useful SSBMO v1.022 (M1-3), the output of the initial iteration of build activity group D3, four findings are apparent:

[1] Evaluation of the 106 items was scored on a scale of 0-5, defined in Table 6-30.

1. The SSBMO can significantly better conceptualize the responses necessary to score highly on the B Lab Impact Assessment Survey than the BMO. This serves as a basic confirmation of the overall validity of both the changes made to the BMO (BP1) and the constructs and model chosen to be added / changed in the SSBMO (7.2.1.4-7). This is asserted because the B Lab Impact Assessment Survey is believed to be conceptually well aligned with the strongly sustainable world-view.

   The feedback was confirmatory: no gaps in utility were revealed; although this could have been due to one or more of the assumptions identified being invalid (although no evidence to suggest this was found, 6.5.3.2), or the potential sources of bias unknowingly invalidated this evaluation activity (6.5.3.3).

2. Neither the SSBMO nor the BMO is intended to directly conceptualize patterns of business design, however both may be used as a taxonomy of such patterns (as shown in Figure 3-9).

   As the most obvious example, the single N/A response is related to items in the B Lab Impact Assessment Survey concerning specific elements of specific business model patterns (e.g. Alcohol, Commercial logging and logging equipment, Firearms, weapons or munitions, Gambling, Genetically modified organisms, Mining, Nuclear Power, Fossil fuel-based oil or coal utility, Payday Lending, Pornography or Tobacco production or processing).

   However, there was no evidence gathered that the SSBMO was lacking any of the constructs or relationships required to model business design patterns of these or other industries.

3. Although the SSBMO scored far higher than the BMO it did not score the theoretical maximum. The gap is a result of the chosen designed limitations of the SSBMO, L2: "In this research details of the business process designs required to execute an implemented business model are excluded" (2.6). Notably this gap was present for both the SSBMO and BMO, since the BMO also has the same designed limitation.

To score the maximum on many items in the B Lab Impact Assessment Survey requires a level of day to day operational detail to be captured in an instantiation of the SSBMO; such a level of detail would inevitably 'over-complicate' the resulting business model. So while in theory this detail could be added (likely via the addition of attributes to many entities), it is unlikely that in practice a business model designer would find it useful work at this level of detail to create their business model. Adding this level of detail would make more significant objectives of business model clarity and broad utility harder to achieve. It is noteworthy that the BMO has the same limitation.

4. To best model responses that would score highly in the B Impact Assessment Survey required the addition of three attributes not included or not appropriately conceptualized in v1.022 of the SSBMO using during this evaluation activity:

   – Locality. The B Impact Survey has a number of items that question the geographic and geo-physical relationships between the firm completing the survey and other stakeholders. Without this attribute responses to such items cannot be modelled.

   – Legal entity type. The B Impact Survey has a number of items which suggest a linkage between sustainable outcomes and the type of legal entities involved in a business model (co-op, incorporated entity, sole proprietorship, not for profit, etc.). Without this attribute responses to such items cannot be modelled.

   – Stakeholder diversity. The B Impact Survey has a number of items which suggest a linkage between sustainable outcomes the relative diversity of a firms stakeholders (gender, race, legal entity type, location, etc.). Without this attribute responses to such items cannot be modelled.

Considering each of the relevant evaluation hypotheses in light of these findings (E1b-EH1-4, 6.5.2.7):

E1b-EH1: ***Confirmed***. Evidence: The absolute low score of the BMO; the BMO lacks the concepts required to conceptualize responses to the B Lab Impact Assessment Survey v3 items that would score highly.

E1b-EH2: ***Confirmed***. Evidence: The absolute high score of the SSBMO, with the gaps to a perfect score being explained by a chosen designed limitation of the SSBMO. The concepts and their inter-relationships required to create responses to score highly for each of the B Lab Impact Assessment Survey v3 items can be described using the SSBMO constructs and model.

E1b-EH3: ***Confirmed***. Evidence: The absolute high score of the SSBMO, with the gaps to a perfect score being explained by a chosen designed limitation of the SSBMO. All the constructs and relationships in the SSBMO are required to represent the responses that would score highly for each of the B Lab Impact Assessment Survey v3 items.

E1b-EH4: ***Confirmed***. Evidence: The absolute high score, the high median, and the low number of low scores. This strongly suggests that the preparation activities, leading to the derivation of the overall and detailed design principles, share the same understanding of the strongly-sustainable key disciplinary frameworks as those used by B Lab in constructing the Impact Assessment Survey v3 items; although the B Impact Survey was derived entirely independently.

Table 8-4 presents the values determined for the relevant three metrics based on these findings.

Metric		Value	
		Confirmatory Feedback	Opportunity for Improvement
M4	Completeness	Satisfactory	– Locality not conceptualized sufficiently. – Type of legal entity for firms in a business model not conceptualized. – Stakeholder diversity not conceptualized.
M5	Level of Detail Satisfactory	Satisfactory	None.
M8	Internally Consistent	Satisfactory	None.

Table 8-4: Value of Metrics of Comparative Analysis Activity – B Lab (E1b, M4-5, M8)

8.5.2.3 Gaps

The determined metric values (Table 8-4) highlight the following gaps artefact utility from evaluation activity group E1b:

GU1: Locality not conceptualized sufficiently (socio/geographic nor bio-physical). In version 1.022 of the SSBMO, the initial output of build activity group D3 (Figure 5-2), locality had not be appropriately incorporated into the SSBMO (DDP6).

GU2: Type of legal entity for firms in a business model not conceptualized, e.g. Benefit Corporation, co-op, not for profit, government, for-profit, partnership, etc.). In version 1.022 of the SSBMO, the initial output of build activity group D3 (Figure 5-2), the legal entity of firms had not be appropriately incorporated into the SSBMO (DDP3).

GU3: Stakeholder diversity not conceptualized, e.g. diversity of the ownership of the organizations in a business model. In version 1.022 of the SSBMO, the initial output of build activity group D3 (Figure 5-2), stakeholder diversity had not be appropriately incorporated into the SSBMO (DDP5 and 6).

Further, the determined metric values also highlight the following gaps in research rigor:

GR3: Additional comparative analysis could yield additional feedback by using additional knowledge sources based on the strongly sustainable world view, but derived independent of the strongly sustainable key theoretical frames (K0-SS).

GR4: Seek methods that further reduce the potential for bias and increase likelihood of gathering feedback concerning opportunities for improvement.

8.5.2.4 Conclusions on Results of Evaluation Activity Group E1b & E4

The overall purpose of this evaluation activity group is "to provide the researcher with 'first-order' feedback on the utility of the SSBMO in fulfilling its objectives [since] it would be imprudent to take a designed artefact to any 3rd parties until the researcher has some confidence of its utility" (6.4.9.3).

From this perspective this evaluation activity achieved this goal and gave the confidence that the design as conceived by build activities D1, D2 and the initial activities of D3 warranted additional evaluation (E1c, E2a) and development (D3 final), prior to being subject to 3rd party feedback (E2b and E3).

8.5.3 Results of Comparative Analysis of The Timberland Company (K3) Knowledge Source (E1c & E4)

8.5.3.1 Introduction

The detailed design for this evaluation group is introduced in 6.4.9.1 and 6.4.9.3 and set out in detail in 6.5.4. The intention is to determine values for metrics M4 (Completeness), M5 (Level of Detail), M8 (Internally Consistent) and M9 (Useful), and to report on evaluation hypothesis E1c-EH1 and EH2.

8.5.3.2 Results

The comparator knowledge source K3-BM was constructed as per 6.5.4.4 and 6.5.4.5. For the reasons noted in 8.3 the construction of comparator knowledge source K1, based on a CATWOE analysis of K3-BM was not undertaken (6.5.4.6).

Comparator knowledge source K3-BM consists of a number of documents contained in the accompanying electronic files listed under the "List of Supplementary Materials" in the Front Matter of this thesis (SM6 and SM7). K3-BM was constructed in the following order:

1. From the public knowledge of The Timberland Company (6.5.4.4) a detailed tabular instantiation of the SSBMO v1.022, resulting from build activity D2, was created using a spreadsheet tool (as per method set out in 5.4.7). This instantiation of the SSBMO is contained in Supplementary Material SM6a.

2. This expression of The Timberland Company business model was then summarized using a presentation tool in a format inspired by approaches taken by Osterwalder in a number of his mini-cases and his major case study (the Montreux Jazz Festival) (discussed in 7.4.3.4, Table 7-40). This instantiation of the SSBMO is contained in Supplementary Material SM6b.

3. SM6a was also summarized using a blank SSBMC v1.03 (SM5c) and post-it notes (as per the method set out in 5.4.8). The result was digitally photographed. This instantiation of the SSBMO expressed using the SSBMC is contained in Supplementary Material SM7.

Note:

- In addition to an analysis of Timberland conducted by the researcher and other members of a Schulich Business School group project team "Green Fund Analysis of Timberland Company" in fall 2010 in the class: SB/BSUS6300 "Sustainability Business Strategies" (Drapeau, Jain, Kist, Lo, & Upward, 2010), Page 30 of SM6b lists the public sources of information consulted to construct SM6 and hence SM7.

- These instantiations of the SSBMO were not subject to confirmation by employees of Timberland (as per 6.5.4.3) during the evaluation activity stream. The values of the metrics reported from this evaluation activity do not reflect the evaluation of these instantiations by the 3rd party experts during the formal 3rd party review activity group (E2b).

Analysing this source of comparator knowledge against the expected, desirable and importance of a highly useful SSBMO (M1-3), seven findings are apparent:

1. In the case of Timberland, significant amounts of information were available in public sources concerning the design of their business processes (Process perspective) and their measurement system (Measurement perspective).

   The researcher found organizing this information using the entities and entity inter-relationships of the SSBMO to be highly effective at gaining an end-to-end understanding of The Timberland Company's business model.

   Further perspective and understanding, particularly of the pattern of inter-relationships between the various elements of The Timberland Company's business model was gained in the subsequent summarizations.

   The additional perspective gained was unexpected since the researcher was already very familiar with Timberland, having completed a B Lab Impact Assessment Survey v2 based on the same public information some months earlier (Drapeau et al., 2010).

2. As suggested by E1b, it is difficult to determine the useful level of detail to be included in a business model. An instantiation of the SSBMO appears quite capable of capturing the full level of information available concerning Timberland. However, it is unclear from this evaluation activity whether including all the information available in a description of The Timberland Company's business model would be found to be useful in practice.

   The comparator knowledge created during this evaluation activity group arbitrarily limited the amount of included detail. For example: in the Process perspective, only the top-level process details were included (Figure 7-11), in the Measurement perspective only high level metrics were included (the full list of metrics Timberland included in their GRI report could have been shown).

3. The definitions of eco-system services and bio-physical stocks relevant to a business are weakly described in existing literature (4.4.3.2). Reworking of the definitions of eco-system services and bio-physical available in the literature was required in order to model Timberland's use of bio-physical stocks and eco-system service benefit flows. The final lists of eco-system service flows and bio-physical stocks developed from the literature are included in Chapter 4 (Table 4-5 and Table 4-6 respectively).
4. The conception of a number of attributes used by the BMO is not inclusive enough to model a business, such as Timberland, that has a publically stated goal of achieving some level of sustainability. The specific missing attributes are listed in Table 8-5.
5. A number of the relationships between entities that existed in the BMO, that appear to be necessary to model a business, such as Timberland that has a publically stated goal of achieving some level of sustainability, appeared to be missing from the BMO. The specific missing relationships are listed in Table 8-5.
6. A number of attributes and entity inter-relationships of new or changed entities in the SSBMO, required to model a business, such as Timberland, that has a publically stated goal of achieving some level of sustainability, appeared to be missing from v1.022 of the SSBMO. The missing attributes and entity inter-relationships are listed in Table 8-5.

Considering each of the relevant evaluation hypotheses in light of these findings (E1c-EH1 and EH2, 6.5.4.8):

E1c-EH1: ***Confirmed***. Evidence:

First, as part of its sustainability initiatives Timberland takes considerable pains to be transparent about most as aspects of its business model at a low level of detail (certainly compared to other profit-first companies). Timberland goes well beyond legal and regulatory reporting requirements. Despite the wide range of information available, all of it could be conceptualized as instances of one or more of the entities of the SSBMO v1.022 and their inter-relationships.

Second, the constructs and model conceptualized in SSBMO v1.022 were found necessary and largely, but not entirely, sufficient to model the Timberland Company business model. This comparative analysis identified a number of attributes and entity inter-relationships missing from SSBMO v1.022 that were required to model the Timberland Company's business model (Table 8-5). However, the large majority of attributes and entity inter-relationships included in this version of the SSBMO were found to be necessary.

E1c-EH2: ***Not confirmed***. The required CATWOE evaluation technique was not applied, for the reasons noted in 8.3.

Table 8-5 presents the values of the four metrics whose values were determined based on these findings.

Metric		Value	
		Confirmatory Feedback	Opportunity for Improvement
M4	Completeness	Satisfactory	***Attributes***: – Target Stakeholder entity missing attribute concerning stakeholder legitimacy urgency and power. – Relationship entity Customer Equity attribute conceptualization from BMO not well suited to concept of a stakeholder. – Link entity Customer Buying Cycle attribute conceptualization from BMO not well suited to concept of a stakeholder. – Offering entity Reasoning, Price Level and Life Cycle attributes conceptualization from BMO not well suited to concept of a stakeholder. – Valuation Method and Stream Type and Pricing Method entities conceptualization from BMO not well suited to concept of environmental, social and monetary revenues. ***Relationships:*** Relationships were found to be missing, but required to appropriately describe the Timberland business model, between the following pairs of entity – Activity and Stakeholder – Asset and Valuation Method – Process Measure and Resource – Bio-Physical Stock and Actor
M5	Level of Detail Satisfactory	Satisfactory	Guidelines for business model designers may be required to ensure a level of detail that yields an appropriate return for the investment in its modelling are required.
M8	Internally Consistent	Satisfactory	None
M9	Useful	Satisfactory	None

Table 8-5: Value of Metrics of Comparative Analysis Activity – Timberland (E1c, M4-5, M8-9)

8.5.3.3 Gaps

The determined metric values (Table 8-5) highlight the following gap in artefact utility from evaluation activity group E1c:

GU4: The attributes and entity inter-relationships listed in Table 8-5 are not appropriately conceptualized. In version 1.022 of the SSBMO, the initial output of build activity group D3 (Figure 5-2), these attributes and relationships, based on a range of detailed design principles (DDP1-6), had not be appropriately incorporated into the SSBMO.

Note that lack of guidelines / process for the effective use of the SSBMO are a designed limitation of this research L6: "Building and designing a design methodology for the use of the SSBMO" (2.6).

Further, the determined metric values highlight the following gap in research rigor:

GR5: For useful values of these metrics to be gathered using the CATWOE technique in a design science research project requires the involvement of 3rd parties unrelated to the artefacts or the process of their creation.

8.5.3.4 Conclusions on Results of Evaluation Activity Group E1c & E4

The overall purpose of this evaluation activity group was "to provide the researcher with 'first-order' feedback on the utility of the SSBMO in fulfilling its objectives [, since] it would be imprudent to take a designed artefact to any 3rd parties until the researcher has some confidence of its utility" (6.4.9.3).

From this perspective this evaluation activity achieved this goal and gave the confidence that the design as conceived by build activities D1, D2 and the initial activities of D3, warranted informal evaluation by 3rd parties (E2a) and development (D3 final), prior to being subject to formal 3rd party feedback (E2b and E3).

8.6 Result of Third Party Review – Informal (E2a & E4)

8.6.1 Introduction

The detailed research design for this evaluation group is introduced in 6.4.9.1 and 6.4.9.4 and set out in detail in 6.6.1. The intention is to determine values for metrics M4 (Completeness), M5 (Level of Detail), M6 (Comprehensibility) and M7 (Real-World Likeness). Further, additional unplanned activities were undertaken that helped determine values for metrics M9 (Useful) and M11 (Easy to Use).

No evaluation hypotheses were established prior to gathering this feedback. This idea was to remain open to any and all feedback from this informal exploratory feedback process.

8.6.2 Results

8.6.2.1 Introduction

Events were held with a range of people who had valid knowledge of business models (K4) and operating firms (K5) from a range of world-views, as per 6.6.1.5.

Table 8-6 provides a complete list of all the 3rd party informal feedback gathering evaluation events undertaken.

E2a Activity	Mode (descriptive / Design)	World-view (1-7)[2]	Venue	Description of Evaluation Activity Event
1a	d	5	University in Toronto	Research group on sustainability and software engineering August 2011
1b	d	2	University Business School in Toronto	Operations and management information systems professor, December 2011
2a	d	4-7	Innovation Laboratory of a Design University in Canada	Review with members of the innovation laboratory January 2012
2b	d	3-7	Design University in Canada	Students and faculty taking part in an masters course on business modelling and policy Innovation, February 2012
3	d	5-7	Community College in Toronto	Students and faculty taking part in an eco-entrepreneurship program, during a course in sustainable business management, April 2012
4	D	4-7	Design Community of Practice in Toronto	Members of the public with an interest in design and staff from a Toronto NGO focused on providing services to recent immigrants, May 2012
5.	d	6-7	Sustainability Business Experts, Toronto	Review with staff member and board member of the Canadian branch of a leading science based sustainability NGO, June 2012
6	d	5-7	NGO Board of Directors, Toronto	Summary presentation to the Board, February 2012
7	d	2-5	Management Consultants, Toronto	Review with a group of a dozen Canadian Management Consultants in September 2012
8	D	2-5	University Business School in Toronto	Students and faculty taking part in an MBA class on the introduction and management of new technology.

Table 8-6: List of all Informal Evaluation Activities Undertaken to Nov. 30, 2012 (E2a)

8.6.2.2 Informal 3rd Party Feedback Gathered Prior to Final Iteration of Build

As mentioned in 8.3, originally only one informal 3rd party evaluation activity event (E2a-1a) was planned, to gather feedback on the initial output of build activities D3 (v1.022 of the SSBMO) prior to the final iteration of build activity D3 (5.7.1.2).

[2] 1 = aggressively profit first, 4 = Neutral, 7 = aggressively strongly sustainable. As informally assessed by the researcher.

Some of the respondents at this event had been involved in the development of one or more business ontologies using an ontology engineering epistemology.

At this event, to explain the SSBMO, a presentation was made to the respondents[3]. Respondents were then informally asked for (and in most cases proactively offered) feedback on the SSBMO based on their understanding of the fit or likeness of the SSBMO design (K0, K0-PF, K0-SS) to their knowledge of business models and operating firms (K4 and K5 respectively).

As the opportunity presented itself, evaluation activity event E2a-1b was undertaken. This individual was also involved in the development a business ontology using an ontology engineering epistemology. This individual responded based on their independent review of a revised version of the presentation made at the earlier event, updated to include the Timberland example instance of the SSBMO, and their reading of Working Paper #1 (5.6.1.2, 7.2.1.2).

These two evaluation activity events both looked at using the SSBMO in a descriptive mode (i.e. respondents examined the SSBMO, but did not attempt to use the SSBMO to design a business model).

The values determined for metrics M4-7 provided input into final iteration of build activity D3. The final version of the SSBMO was developed (v1.031) and the SSBMC was then developed (v1.03) (5.7.1.2).

8.6.2.3 Informal 3rd Party Feedback Gathered Subsequent to Final Iteration of Build

As also mentioned in 8.3 (item #3), in addition to E2a-1b (described above) eight additional informal evaluation events were undertaken as the opportunities presented themselves (for a total of nine additional informal 3rd party evaluation activities). This based on the principle that greater quantities and diversities of feedback could only be informative. Hence, these events gathered feedback on the final version of the SSBMO (v1.031) and the SSBMC

[3] This did not include an example instantiation of the SSBMO since evaluation activity group E1c had not yet been started (6.5.4).

(v1.03) helping to determine values not only for metrics M4-8 but also (informally) M9 (Useful) and M11 (Easy to Use).

To explain the SSBMO and the SSBMC the earlier presentation was revised and shown to the respondents. In addition, an instance of the SSBMO, the business model of The Timberland Company (K3-BM), was also shown expressed using the SSBMO (See Supplementary Materials SM6a, SM6b and the SSBMC SM7 listed in the Front Matter).

Respondents were then informally asked (and in most cases proactively) offered feedback on the SSBMO and SSBMC based on their understanding of the fit or likeness of the SSBMO design (K0, K0-PF, K0-SS) and its use (K3-BM) to their knowledge of business models and operating firms and not-for-profit organizations (K4 and K5 respectively).

Although out of the formal scope of this research (see Designed Limitations, 2.6, L4: Use in a design setting or mode), two opportunities to use the SSBMO in a design mode presented themselves (Table 8-6, E2a-4 and E2a-8), and these also gave some valuable feedback on artefact utility (8.6.2.5).

8.6.2.4 Other Informal 3rd Party Evaluation on Research Problem Validity and Artefact Utility

Finally, as mentioned in 8.3 (item #4), there has been an opportunity to conduct a number of other informal 3rd party evaluations. These occurred after the window for feedback closed, but never contributed to informing an understanding of the validity of the research problem and utility of the SSBMO (and SSBMC).

Osterwalder noted that the communities "level of interest" in the BMO (Osterwalder, 2004a, p.128) had some bearing on the validity of his ontology. Hence, it is of note that for the SSBMO and SSBMC, to date, in all the interactions where I have had the opportunity to give short or long explanations of this work, the overall reaction has been positive. Further, as shown below, in many cases has led to invitations to further explain and present the work. I have not had any negative initial reactions; indeed there have been some very positive reactions to the concept and form of the SSBMO and SSBMC.

As examples:

1. The lack of effort required to secure the additional 10 informal 3rd party evaluation activities (E2a-2 thru 8); Very limited effort was expended to seek out these opportunities; in many cases people found me (via my web presence)

2. In arranging the participants for all the evaluation activities none of the people approached turned down the opportunity to participate due to lack of interest or feelings that this work was irrelevant.

3. One organization, who is not involved in this research, felt so strongly that the unfinished SSBMO could help their organization, hired the services of this researcher's consulting company to help them with their business model.

4. A group of academics in the Ontario College of Art and Design University Faculty of Design Strategic Innovation Lab who were involved with the popularization of Osterwalder's work, asked the researcher to co-found an action research group to further this research: the Strongly Sustainable Business Model Group[4]. This group subsequently attracted one of Canada's leading research / practitioner in the business case for sustainability.

5. As a result of these activities and the extensive web presence[5] of this research, the researcher has presented to:

   – 20+ employees around the world of a leading science based sustainability NGO and affiliated for-profit consulting companies (Brazil, Portugal, Sweden, Netherlands, Italy, UK, U.S.A., and Canada, December 2012 and March 2013)

   – Employees working on one of the UK's leading sustainability NGO's (December 2012)

[4] http://slab.ocad.ca/the-strongly-sustainable-business-model-group-ssbmg and http://www.SSBMG.com
[5] At the time of writing (March 2013), the vast majority of the results listed on the first two pages of a Google Search of "Strongly Sustainable Business Model" are related to this work. This work also shows up on the first page of a Google Search of "Sustainable Business Model".

- 20 Members of the a leading European total quality management special interest group with an interest in sustainable business models (March 2013)
- ~30 Students and faculty at a Scandinavian university with a well respected masters and PhD program in sustainability (January and March 2013).

As mentioned these interactions lend considerable face-validity of both the research problem and the utility of the SSBMO in solving this problem has been gathered:

- The fact that organizations wish to engage in consulting work using the SSBMO.
- The very substantively positive comments received about validity of my research problem, my chosen approach to solving the problem, and the SSBMO and SSBMC artefacts.

8.6.2.5 Result Summary

Analysing the E2a source of comparator knowledge against the expected, desirable and importance of a highly useful SSBMO (M1-3), eight findings became apparent based on the informal feedback from the participants, their observed reactions and level of engagement:

1. Useful strongly sustainable business modelling tools
   - Must not be prescriptive or depend for their utility on users having a particular world-view.
   - Can (must) include knowledge from contradictory world views.
   - Must not attempt to model all (most) operational details of a business (examples include detailed task level business process designs and function/organizational structure design).

   These findings lend support to the validity of ODP2, DDP5 and DDP6.
2. The BMO is necessary but insufficient at conceptualizing many of the aspects of a strongly sustainable business model. This lent support to build principle #1 (BP1).

3. The importance in the shared (K0) and strongly sustainable world views (K0-SS) of the proposed definitions of flourishing, value, decision (i.e. governance and power). This finding lends support to DDP6.

4. That the following details within the shared world-view (K0) are important:

   – Biophysical stocks can neither be created nor destroyed and suggested the appropriate verb is 'transformation' (which includes transformation through space – i.e. movement).

   – Organizations gain privileged access to biophysical stocks and eco-system service benefit flows; organizations do not have control over, a right to use or own these stocks and flows.

   These findings lend support to the validity of ODP1, DDP3 and DDP6.

5. That the time frame for the needs of actors (and stakeholders) is important. This finding lends support to the validity of DDP4.

6. The SSBMO is useful to practitioners, lending support to metric M9. Management consultants reported that they expected their clients to find the SSBMO useful (gathered during event E2a-7).

7. The SSBMO is both comprehensible and useful, and the SSBMC is useful, specifically in a design mode:

   – The leader of the Toronto NGO focused on providing services to recent immigrants observed that the SSBMC was helpful in planning innovation over a 3 year period (E2a-4)

   – A business school professor suggested that the student's use of the SSBMC to design a response to a case study engaged the students; he observed the students gaining insights about the case they would not otherwise have achieved (E2a-8). Further the students from this group suggested that the SSBMC:

- Was a good tool to help connect all the piece of a sustainable business model together.
- Helped them see the context for what they were doing.
- Helped ensure they considered all the parts of a business model.
- Was useful in brainstorming ideas for more sustainable business models.

These findings lend support to values of metrics: M4, M5, M6, M9, and M11 (Table 8-7).

8. The SSBMC requires an efficient and effective means of explanation that the current briefing presentation does not sufficiently provide. For example several participants felt the definitions / descriptions of stakeholder, actor; channel, relationship and partner were not sufficiently clear.

Table 8-7 presents the values of the six metrics whose values were determined based on these findings.

<table>
<tr><th colspan="2" rowspan="2">Metric</th><th colspan="2">Value</th></tr>
<tr><th>Confirmatory Feedback</th><th>Opportunity for Improvement</th></tr>
<tr><td>M4</td><td>Completeness</td><td>Satisfactory</td><td>Relationships:
– The concept which the relationships between the Bio-physical Stock and Resource entity and Eco-System Service and Activity entity are intended to model needs careful capture and coding.
Attributes:
– Need and Criterion entities are missing attribute concerning time horizon for a need[6].</td></tr>
<tr><td>M5</td><td>Level of Detail Satisfactory</td><td>Satisfactory</td><td rowspan="5">A methodology that includes a comprehensive but easy to follow description of the SSBMC and a recommended process for its efficient use is required.</td></tr>
<tr><td>M6</td><td>Comprehensibility</td><td>Satisfactory</td></tr>
<tr><td>M7</td><td>Real World Likeness</td><td>Satisfactory</td></tr>
<tr><td>M9</td><td>Useful, has Utility to Intended User</td><td>Satisfactory</td></tr>
<tr><td>M11</td><td>Easy to Use</td><td>Satisfactory</td></tr>
</table>

Table 8-7: Value of Metrics of 3rd Party Expert Review Activity – Informal (E2a, M4-7, M9-11)

8.6.3 Gaps

The determined metric values (Table 8-7) highlight the following gaps in artefact utility from evaluation activity group E2a:

GU5: The conceptualizations of the entity inter-relationships listed in Table 8-7 are neither fully appropriate nor complete. In version 1.022 of the SSBMO, the initial output of build

[6] E.g. In version 1.031 of the SSBMO ideas such as the desired time horizon for a firm to continue to exist, cannot be captured. For example it is typical for 'high-tech' start-up firm founders to want their firm's to exist until they engineer an acquisition by another (established) company.

activity group D3 (Figure 5-2), these relationships, based on a range of detailed design principles (DDP1-6), had not been appropriately incorporated into the SSBMO.

GU6: The attributes listed in Table 8-7 are not appropriately conceptualized. In both version 1.022 and 1.031 of the SSBMO, the initial and final output of build activity group D3 (Figure 5-2), these attributes, based on a range of detailed design principles (DDP1-6), were not appropriately incorporated into the SSBMO.

Note that lack of a method for the effective use of the SSBMO is a designed limitation of this research L6: "Building and designing a design methodology for the use of the SSBMO" (2.6).

8.6.4 Conclusions on Results of Evaluation Activity Group E2a & E4

The overall purpose of this evaluation activity group was gathering external feedback on the SSBMO design, adding some initial 'second-order' feedback to the 'first-order' feedback gathered in the comparative analysis evaluation activity group (E1). Gathering some external feedback was considered important prior to completing build activity D3 and the iteration of the SSBMO to be evaluated via formal interaction with 3rd party sources of comparator knowledge (6.4.9.4).

From this perspective this evaluation activity achieved this goal and gave the confidence that the design as conceived by build activities D1, D2 and the initial activities of D3, warranted further development (D3 final), prior to being subject to formal 3rd party feedback (E2b and E3).

8.7 Result of Third Party Review – Expert Interviews (E2b & E4)

8.7.1 Introduction

The detailed research design for this evaluation group is introduced in 6.4.9.1 and 6.4.9.4 and set out in detail in 6.6.2 and 6.6.3. The intention is to determine values for metrics M4 (Completeness), M5 (Level of Detail), M6 (Comprehensibility), M7 (Real-World Likeness), M9 (Usefulness), M10 (Elegance) and M11 (Ease of Use), and to report on evaluation hypothesis E2b-EH1.

8.7.2 Respondent Demographics

Table 8-8 compares the expected and reported world-views and industry expertise of the 3rd party expert interviewees (Table 6-36 set out expected values). The reported values were gathered through items E2b-Q-DG-1d, 2 and 8.

Interviewee ID	Expected World-view*	Reported World-View*	Reported / Assessed Role[7]	Expected Industry	Reported Industry
E2b-1	6	7	Leader / Owner	Education	Education; Manufacturing
E2b-2	6	6	Manager / Team-Leader	Sustainable Business NGO / Multiple	NGO; ~1000 for profit businesses attempting to be sustainable in multiple industries
E2b-3	5-6	7	Leader / Owner	Consulting / Multiple	Real Estate; Management; Construction
E2b-4	5	6	Manager	Nature NGO / Multiple	Multiple; 100's of for profit businesses in a 'brown-field' eco-industrial zone.
E2b-5	4	7	Consultant / Author	Consulting / Multiple	Manufacturing; Transportation & Logistics; Health Care; Finance; Education
E2b-6	2-3	3	Teacher / Researcher	Education / Multiple	Higher Education; Insurance; Retail; Utilities; Financial Services
E2b-7	2-3	3	Leader / Consultant / Teacher / Owner	Consulting / Multiple	Manufacturing; Finance; Insurance; Warehousing; Education

* 1 = aggressively profit first, 4 = Neutral, 7 = aggressively strongly sustainable

Table 8-8: Comparing Expected and Reported Expert Interviewee Basic Demographic Information

[7] For confidentiality reasons titles have not been included; in some cases the role was assessed from the title and a description of their role within the organization provided by the interviewee.

The match between the expected and reported world-views, the senior level of the interviewees and the level of industry diversity supports the desired cohort validity and variety as per the evaluation world-view and triangulation requirements (6.3.2.2, 6.6.2.4).

In addition, other demographic information was gathered to understand the baseline knowledge of the interviewees using items E2b-Q-DG3..7 (Table 6-39). Table 8-9 summarizes this information that concerns the level of knowledge about firms in the industries in which expertise was claimed, the importance to business success that the interviewees placed in business models, their experience designing business models, best practice business model designs and whether they used any tools for this design work. All questions, but one, were asked on 7 point scales, summarized in the footnotes.

Interviewee ID	**Level of Knowledge of Firms in Identified Industries**[8]	**Importance of Business Models and Modelling to Firm Success**[9]	**Level of Expertise Designing Business Models**[10]	**Level of Knowledge of Best Practice Business Model Designs**[11]	**Use of Tools & Formalisms to Undertake Business Model Design**
E2b-1	3	7	4	3	No
E2b-2	6	4	5	5	Not Applicable in Current Role
E2b-3	5	6	3	2	No
E2b-4	5	6	4	3	Not Applicable in Current Role
E2b-5	5	6	4	3	No
E2b-6	4	6	4	3	Yes
E2b-7	6	7	6	4	Yes

Table 8-9: Baseline Knowledge of Expert Interviewees

[8] Scale: 1-7 – 1 = knowledge of most aspects of one to three firms, 7 = deep knowledge all aspects of ten or more firms
[9] Scale: 1-7 – 1 = always unimportant, 4 = can be important, 7 = always very important
[10] Scale: 1-7 – 1 = no expertise, 4 = some experience of designing business models, 6 = highly proficient, design business models regularly as part of my work, 7 = I helped to write a textbook on business model design
[11] Scale: 1-5 – 1 = no knowledge, 3 = some knowledge, 5 = complete knowledge.

Based on the knowledge of the experts gained during the interview process (6.6.3) it is felt the interviewees were being modest with their level of expertise and knowledge.

The lack of the use of formal tools was somewhat surprising; none of the interviewees had anything other than a general knowledge of the BMC, and most only a passing awareness.

Finally, together all this demographic information supports the values of the contextual metrics presented in Table 8-2. It was clear from the interviewees responses to these demographic items that they felt a tool to help more efficiently produce high quality (strongly sustainable) business models (the research question, RQ) was highly important (M3) and desirable (M2). Further there was a high or very high expectation (M1) that what would be presented to them would useful.

8.7.3 Results

8.7.3.1 Introduction

The protocol described in 6.6.3 resulted in the comparator knowledge sources described in 6.6.2.4 and Table 6-37:

- Knowledge and expertise about business models (K4)
- Operating firms in various industries (K5).

8.7.3.2 Findings

Analysing these comparator knowledge sources against the expected, desirable and importance of a highly useful SSBMO and example instances of the SSBMO (Timberland, K3-BM) (M1-3), 19 findings are apparent:

1. Each respondent was consistent in their perspective on the ontology and instances of the ontology. If they liked an aspect of one, they liked the same aspect of the other. Lends support to the comprehensibility of the SSBMO (M6) due to high level of internal consistency (M8).

2. That the following details within the shared world-view (K0) are important:

   - The strongly sustainable requirement to simultaneously consider the environmental, social and economic leads to the need to integrate the firm's performance in each these contexts. Firms should not try to "balance" (i.e. trade-off) performance in one context with performance in another.

     "I took issue with your use of the word balancing because given your description of the sustainability and using the embedded model, it seemed to me that balancing suggests sort of that dichotomy that you're at one end or the other, that you can't have both. In an embedded model, I think you can have [both]. You're not taking away from the environment in order to achieve good profit within the embedded model, that you're achieving good profit through better management of the environment and through better societal [actions]" (Respondent E2b-1 with a strongly sustainable world-view).

     "I crossed out the word 'balancing.' […] because I believe that it's possible to achieve all of these at the same time without having to take away from one to balance with another" (Respondent E2b-3 with a strongly sustainable world-view).

   - A key difference in beliefs arising from the profit-first vs. strongly sustainable world-views appeared to be the relationship over time and at points in time of the achievement of environmental, social, and monetary benefits.

     Respondents with a profit-first world-view tended to assume that improving one type of benefit required the reduction of the others. As one respondent with a profit-first world-view (E2b-6) put it "Well, I'd like all three bottom lines. But it's like the iron triangle in project management[12]: if I push one [corner], the other one moves. So can this model help me see that movement? That's what I'd love

[12] This common model used in project management suggests that in any project the quality of the results are constrained by *a combination of* cost, schedule and scope. E.g. you cannot reduce cost without reducing schedule, scope or quality. You cannot reduce schedule without reducing either scope or quality, etc. This model suggests that project management is always necessarily about trade-offs (Wikipedia Authors, 2012b).

to see this model do in the long run. It would be so cool." i.e. trade-offs are mandatory, and that the role of management is to determine the trade-offs with the fewest drawbacks to value created for that organization's legitimated stakeholders.

In contrast, as noted above through the use of the word "integrated", the literature on strong sustainability (4.6), the respondents with a strongly sustainable world-view believe that such trade-offs are not required, and indeed no such connection between the types of benefits exist.

Related to this, one respondent with a profit first world-view (E2b-6) did not understand how the model could be used to help a firm understand their broad context (environmentally, socially, and economically/market), nor that existing businesses might have a need to (re)design their business model: "Start-ups might find it a useful exercise; the business might be better thought through which might impact success" but "existing businesses don't need to design a business model - so unsure if this is useful to them". In contrast respondents with a strongly sustainable world-view not only recognized that to achieve the different goal of strong sustainability a business model (re)design was required in all cases, but that the SSBMO could help with fully understanding the context for this redesign and improve the quality and efficiency of this redesign.

3. The protocol included a 60-90 minute briefing, and a request that the interviewees invest some time studying the SSBMO, the example instance (K3-BM) and the supporting materials, before the interview. However, it was clear from the responses to many of the items (particularly about completeness and comprehensibility) that:

    - While the briefing presentation had been informally tested at a number of the informal evaluation events (E2a), the explanations of some aspects of the SSBMO could have been further improved.

- While individual constructs and their inter-relationships may be clear, it is cognitively effortful to integrate and internalize all these elements into a useful mental model.
- Some interviewees reported spending more time than others between the briefing and data gathering interview and they felt this was a driver for some of the differences in feedback provided.

4. With a few explicit exceptions (reported separately), respondents thought the SSBMO complete (M4) and comprehensible (M6): "I guess I've seen lots of different [business model] designs, well over a few thousand companies. I think you've covered it" (Respondent E2b-2).
5. Experts thought the level of detail (M5) of the conceptualization of the constructs and their inter-relationships necessary, sufficient and an improvement over the utility of earlier models and tools:

- "You've ratcheted it up to the next degree of specificity and made sure that it is truly about sustainable businesses. Whereas the current [tools] that I've seen, honestly could be applied to any kind of business" (Respondent E2b-2).
- "[What] I really liked is that it really makes you think about things that you would never think about before, right? So it really expands that focus, or expands the scope of what you're looking at" (Respondent E2b-5).
- "Osterwalder's PhD was probably brilliant, but it was the resulting tool and conceptualization that really helped people move forward." "I thought Osterwalder was quite brilliant in the kind of parsimony and the clarity of his [canvas]. Now it may not be [technically] correct, but it looked good. If your model, basically, takes his model and adds the pieces that are missing to bring in the social and the biophysical views of the world, then it's going to be really useful, very useful. Because then people can just use it like they would use his" (Respondent E2b-6).

6. All the respondents reacted positively to the context generalizations (environment, society, monetary economy), irrespective of their world-view, lending support to DDP3:

   - "It asks some good questions or puts some good things on the table like the question about separation of man versus nature. It says that that's a wrong way of thinking, that there's a different way of thinking. It questions the profit primacy which I thought is good and it has embedded in a model of sustainability" (Respondent E2b-1, with a strongly sustainable world-view).
   - "The three layers, very cool" (Respondent E2b-6, with a profit-first world-view).
   - "The power of this thing is it's really the first to take the social aspect and the bio-physical into consideration. And I haven't seen that that any other business model would take that into consideration" (Respondent E2b-7, with a profit-first world view).

   However, it was recognized this presents challenges for representing the additional complexity and respondents were torn between the scientific validity of these ideas, the need for business people to make decisions that take this reality into account and the possibility for the rejection of any tool, due to this apparently necessary complexity:

   - "It hurt my brain […] I think it was trying to three dimensionalize things, pop outs […] What would have been perfect, you know how you get on some of those television shows where they have the three dimensional hologram and it spins around in front of you and you can negotiate it. That's what you need" (Respondent E2b-1).
   - "I think that it would be more aesthetically elegant if there was a means to present this three dimensionally. Because obviously two dimensional doesn't lend itself well to the complete elegance of the model" (Respondent E2b-3).

- "I understand this model, but I'm also thinking about how other people would-could be quite confused in terms of-because this really is a lot of-a lot of information. And what's really representing in here is how [the context generalization entities] and [the specific entities] have an impact on [each other]." "It's a very nice two-dimensional diagram. It really is impressive, but a lot of people will not see that third dimension and the impacts. And, I think that's important, [… But to see the impact of that 3rd dimension takes practice] 'if this changes, then you-then it might have an impact on something else' ". "You're showing it as a two-dimensional concept, but it really is a three-dimensional concept. […] I can see that hologram and I can see being able to spin it around and pull out certain parts of it and I can see you putting different data into it and watching different pieces of it grow. I think animated in that way you'd really have people's attention. I don't know if you're 20 years away from that" (Respondent E2b-7).

These same respondents, who had divergent world-views, also gave some of the most positive responses to the items concerning completeness, level of detail and comprehensibility of the SSBMO (see above). This would suggest that it is the visual representation which requires improvement, rather than addressing conceptual weaknesses.

However, current (ecological modernist, i.e. Corporate Social Responsibility) conceptions of sustainability in organizations don't map well to this holistic perspective. As respondent E2b-5 explained, today sustainability is commonly understood as a "thing" or "goal" to which specific people must be held accountable, as opposed to monetary profit which is, in our culture, well understood to be embedded in everyone's job in a profit-seeking enterprise. Such an un-integrated understanding of sustainability is hard to see in the SSBMO; about the only place such an understanding could be modelled is in the Decision (Governance) entity, by recording, for example the decisions for which a 'VP Sustainability' would be responsible.

One respondent (E2b-7) with a profit-first world-view, went on to suggest that the inclusion of the Decision entity was vital for this very reason, describing his approach to business model design as "responsibility driven design".

7. Generally the perspective generalization entities were well regarded as an organizing and structuring concept. "I think the use of Kaplan and Norton[13] is excellent. I mean, I think that really works. […] It works perfectly. People understand. Because I'm always looking to the endgame here, which is whether somebody will ever use this. So I think using the Kaplan and Norton [model] is brilliant. So that's great" (Respondent E2b-6).

8. Generally respondents reacted positively or very positively to the completeness, level of detail and comprehensibility of the constructs and the model captured and coded in the SSBMO. This was in relation to both the visualization of ontology itself (SM3) and the instantiation of the SSBMO describing The Timberland Company's business model visualized using the SSBMC (K3-BM, SM6b).

   In some cases this latter reaction was based on general knowledge (as a customer of Timberland), in other cases it was because of direct professional interactions with Timberland (formal research for a book, consulting, or accreditation/audit work). In one case a respondent declined to react to utility of the instantiation suggested they didn't feel they had enough knowledge of Timberland.

   - "I think you've got enough there for them to place what [Timberland] actually do within the context" (Respondent E2b-1)
   - "The design of the ontology I thought was pretty well thought out and clear." "I think the [entities] were very well thought through" (Respondent E2b-2)
   - "I think that [all the boxes] were all necessary to some degree. […] And so, I think the design of it great in terms of how it manifests a company." "It will help

[13] Kaplan and Norton were the authors of the Balanced Scorecard concept which underpins the Perspective generalization entities (7.3.3, 7.2.1.5).

sort of map out all of the stuff that we should be talking about when talking about Timberland” (Respondent E2b-2).

- “[The ontology] it’s very clear .” “[The description of Timberland] is useful. It’s more detail than I had expected. So I was delighted by the level of detail. [Its far more detail than] I’m accustomed to receiving about companies and their operations” (Respondent E2b-3).
- “I may ask my colleague a couple of questions to understand their perspective and their interest, and then I may choose to point out certain aspects in here to that colleague. Whereas a colleague that has other interests and other perspectives, I may point out different aspects, depending upon what is of most interest to them. And there’s enough richness here that you could have those kinds of discussions with a whole variety of people” (Respondent E2b-3, talking about ease of describing Timberland’s business model, described by SM7, to an imagined colleague, item E2a-2-Q-FI3).
- “All of the constructs purposes make sense” “It is meaningful mainly because it simplifies the approach and puts the various elements into boxes that are easily understood with clear lines of separation” (Respondent E2b-4).
- “I think that [the entities are] pretty clear. Once you look into them-once you, you know, sort of get your explanation on them and things like that. [But,] I would say that, at first sight, it can be a little daunting to figure out, you know, what each one of these things are”, but “it’s useful. Yes, I would say it’s useful because it makes you expand the focus and what you think about” (Respondent E2b-5).
- “I’m looking at it and going, ‘I don’t even know how you would simplify this’. I mean-Yeah, because I don’t see anything in here that’s, you know, unnecessary or, you know, [that] once you look into it, you can’t figure it [out]” (Respondent E2b-5).

- "If I was just to explain what Timberland was about and what their business model was about, I would say, you know, simply 'they are, you know, a company that's moving towards sustainability, and they take, you know, social, environmental, economic impacts into account in all their decisions that are, you know, strictly being driven by profit.' [… i.e.] the elevator pitch level. [But] I completely understand if you were sort of spending an hour talking about Timberland at that next level of detail down [… the canvas] would help to explain it in more detail, yeah" (Respondent E2b-5, reacting to the SSBMC description of Timberland, K3-BM, SM7).

- "I think it is a very good model" "I went through all [the entities], and I did not find anything that was unnecessary" "I think it's very useful. It talks about general relationships. And you can see on a two-dimensional level what the impact of one [entity] has on the other." "I think [management] will see it as inclusive. It's easy to use. I don't think they'll see the complexity behind it" (Respondent E2b-7, reacting to the SSBMO, SM3).

- "I thought it was really good." "Yeah, this was really impressive. It really is. It really is impressive." "Yes, I thought it was one of the best enterprise models I've seen in a long time, if not the best." "There's-there's no comparison between having it and not having it. I couldn't explain it if I did not have it. This gives me a really well-defined structure to explain the Timberland organization" (Respondent E2b-7, reacting to the SSBMC description of Timberland, K3-BM, SM7)

This is not to say that individual respondents didn't individually have difficulties with the comprehensibility, completeness or level of detail of the SSBMO. But the following items of feedback were each only made by one respondent:

- E2b-1 had difficulty understanding the definition of the "Value Configuration" entity (unsurprising, since this is an academic technical term used in the BMO and carried over unchanged).

- E2b-2, with specific professional knowledge of Timberland, thought the summary level of detail about Timberland (SM7) was insufficient and hence could be generic to several companies in that industry. This respondent did not have time to study and report on the detailed tabular instantiation of the SSBMO describing Timberland (SM6a).
- E2b-3 had difficulty understanding the definition of the "Tri-Profit" entity (unsurprising since this is a neologism and only introduced during the briefing presentation).
- E2b-4 wanted more detail about the current and desired values of the instantiations of the entities in the Measurement Perspective for Timberland. This wasn't possible, partly due to this information about Timberland not being publically available, and partly due to the time required to describe / summarize this level of detail.
- E2b-5 noted that many people think about technology as a topic which needs to be considered as a single topic, and wondered "I don't know if technology needs to be [an entity]", but also this respondent recognized that technology was "built in into a number of different [entities]".
- E2b-7 thought there was a lot of confusion in the practitioner community between the concepts of capabilities, activities and processes. But this respondent did not offer a resolution to be applied to the SSBMO.

9. Two respondents, responding to item E2b-2-Q-FI8b, offered comments implicitly in relation to Working Hypothesis 3 and 4 (WH3 and WH4, 2.4): that a tool would have value to managers if it allows them "to understand gaps in their organization's approaches to increasing sustainability", i.e. if a tool offered a diagnostic mode:

- Respondent E2b-6 highlighted a gap in the utility of the tool, based on the example instantiations, to diagnose problems in a firm's operations compared to its declared statement of success.

This respondent identified that the visualization did not show whether a given instantiation of an entity was felt to be important to achieving Timberland's goals, vs. those that existed but either were no longer necessary to achieve current goals, or were not sufficient to achieving current goals: "this model is only at one level, it treats everything with the same level of importance. I can't really tell, from this model, what Timberland is really strong at and what it's weak at. […]. They may execute [some things] very poorly, or they may provide no resources to one; and another, they're absolutely world class on. And it's still the same level of [sticky note]".

"The underlying problem is that this diagram treats everything at the same level. There's no evaluative process. There's no way I can put one sticky and make it red, and say 'That's badly done' or 'we have problems here'. Now you can use [the SSBMC] to do that. But as I look at [your example], [while] I see what Timberland says it does I don't actually see what it's good at; maybe it's a failing business! So all of that is left off the page, which is fine, as long as you understand that that's a limitation of this [example] model".

- Respondent E2b-2 commented in a similar vein: "I don't think it'll be useful for identifying problems [with existing businesses]. [But] I think that it will be useful for identifying potential changes, because you can kind of see what's missing. But just because it's missing doesn't mean it's a problem" (Respondent E2b-2).

  This respondent went on to note that the Timberland business model expressed using the SSBMC was "a conversation starter, for sure", but went on to note a gap: "it won't help me explain why Timberland itself is successful. But it will help sort of map out all of the stuff that we should be talking about when talking about Timberland".

10. When commenting on both the SSBMO (SM3) and the example instantiation of the SSBMO describing The Timberland Company's business model visualized using the SSBMC (K3-BM, SM7) all respondents commented on several aspects of the

usefulness of these representations to improve their understanding of companies business model:

- "I liked the idea of how you could compare it to competitors or best in class" but that "it would be all about education. I like what you did when you presented it, how you built it a piece at a time and then showed how it all came together and showed the 3D and then the two- dimensional. I think, providing that people are willing to spend the time to be educated on the various pieces and have more education than [the one hour] even I got, I think yes, I think it would be usable" (Respondent E2b-1).
- One respondent felt the SSBMO had utility because it supported the systems thinking assumption that a humble approach to the completeness of our knowledge and our ability to know: "One of the things it does is it presumes that we can't know. So there's some things we can't know, but it brings us closer than we have ever been" (Respondent E2b-1).
- "How could this ontology be used by an organization, with or without external consultants, to help that organization shift its collective mindset? [It could help] because it raises questions. And if there isn't information to [answer a question], the benefit […] will […] be […] the experience that the collective organization goes through to answer those questions. [This] may be of greater value than actually answering the question" (Respondent E2b-3).

  Respondent E2b-6 lent support to this perspective, stating "the actual process of completing the model is absolutely critical. If I sat in my office and completed it, I don't think it's useful at all".
- "I find this a very neat and organized way of describing [Timberland's] model all in one spot, which is actually why I asked you the question-did you have to do a lot to pull the information together? Because if you did have to do a lot to pull the information together, I think that's an added benefit of this model that it lends itself well to describing a lot of information and the interconnections between

that-the aspects. That that in itself could be useful for organizations" (Respondent E2b-3).

Despite this, later this same respondent suggested that while the tool addressed the problem well, the problem of designing a strongly sustainable business is complex. Hence from their perspective it would be relatively easy to use the SSBMC to design a new strongly sustainable business, but relatively hard to use the SSBMC to redesign an existing profit-first business, i.e. "taking an existing [businesses business] model and shoehorning it into a new model, you might end up putting in more effort in that shoehorning process than it's worth. It may be better to start [a new business] from scratch".

However, another respondent with a strongly sustainable world-view (E2b-5) disagreed, stating that as long as an existing firm understood what sustainability meant and had bought into it, then using the SSBMC "would make it easier than not having anything to work with. Absolutely. There's no question about it." Further this respondent felt this utility would be there whether designing a new or redesigning an existing business model.

- Reporting on the impact on business model designer efficiency, respondent E2b-4 stated "I think the model can make [design] faster because it's intuitive." "I think it would be easy for a company to utilize [the SSBMC] as a way to design a business model." "I think the model can help break down Timberland's approach to business to bit sized pieces for an introductory discussion."

- Respondent E2b-6 also commented on the utility of the SSBMO for product and service design: "[since the SSBMC allows] understanding broader impacts it can help define the best way forward for a product; I would use it for such a project."

  This perspective was supported by other respondents:

  – E2b-4: "I believe it would be helpful as it brings in a number of other factors that are not typically provided for in a company's analysis of their business model. The addition of stakeholders outside of the company and the firm's connections to the broader societal context, help draw the big picture for a firm in a sustainable fashion. The big picture can not only help them look at their impacts, but also better understand their position in the marketplace and the value of their product".

  - E2b-5: "I could see at first more people using it to design changes to a product line or a division. Because they're going to go, 'You know what? I'm not going to start with the whole company, but let's start with this little piece here and see how we can make that little piece more sustainable' ".

- Respondent E2b-5, noting that the example instantiation of the SSBMO describing The Timberland Company's business model visualized using the SSBMC (K3-BM, SM6b) "would help to explain it in more detail" also felt strongly that this level of detail was too much to get a conversation started. Indeed they felt it might make people reject exploring the utility of the model at all.

  This respondent felt an even more summarized view would be required to engage people and get them interested, before turning to the SSBMC for a more detailed discussion: "From a practical perspective, it would be an extreme challenge to get companies to sit down and redesign their whole business model. On the other hand, I think they need to do it. And if they did it they would see the value in it." "[So how do you get people to engage with it,] how do you explain it in 30 seconds or less? […] I would just be afraid that somebody looking at this would go, 'Okay, I'm not too intimidated by it, but I've got to spend a lot of time figuring things out'. But, of course you have to do that with anything."

  This perspective was also reflected by respondent E2b-3 who suggested the SSBMC would be useful in a workshop mode, "versus the presentation mode where, based on the audience's specific interest, you want to zoom in on that particular aspect, which may still be holistic, but may be a view of that holistic world based on that audience's interest. And it then may be possible to reduce the number of elements significantly to get the, you know, down to the five plus or minus two or seven plus or minus two type of idea".

- "[It is useful to illuminate previously unexplored relationships. [… It] may be useful to make a company more amenable to pursing a diverse set of outcomes" "if you have a reason [a decision to make], then I think it's a good tool. But it won't probably ever be done completely; it will only be done at enough pieces to allow them to see the alternatives and allow them to go off and make a decision" (Respondent E2b-6).

- Respondent E2b-6 also felt the ontology was too complex for practical use, but thought the 14 questions on the SSBMC overview (SM5a) was "getting there" noting that "the stickies[14] make it very powerful". However this respondent also noted limitations with utility of the model, suggesting that by the nature of the tool (i.e. a designed limitation) the SSBMO does not lend itself to an external analysis (a la the Five Forces Model, Porter, 1985) nor to assisting with business model implementation or execution (business operations).

- Finally, discussing overall utility, respondent E2b-7 stated: "The efficiency [is] because [the tool helps] organizations to understand what the concept of what they're trying to get to, the context, the knowledge that they have currently, what they need to do, and then the structure. If they have a well-defined business model like this, this becomes a very, very powerful tool in terms of doing predictive analysis or just doing what-if scenarios. If we do this, what-what will the process and what impact will it have on all the aspects of not only our company, but also on society".

11. Respondents also provided their perspective on the roles of the people and organizations who would find the SSBMO useful, albeit with the caveat that the level

[14] i.e. the use of the post-it notes in the overview SSBMC diagram (SM5a) and example instantiation using the SSBMC (SM7), as described in 5.4.8.

of summarization or range of concepts included may need to change based on the audience:

- "I think the sustainability directors for sure would have to be able to understand. They're the first ones to be able to understand the integrated nature of this" (Respondent E2b-1).
- "I think that gets the entrepreneur juggling variables" and for "traditional [profit-first] businesses […] trying to figure out how to make it sustainable […] I think it would add a lot" (Respondent E2b-2).
- "Everybody involved in the decision making process from executives to senior managers, functional managers, as well as those who report to managers that would work on pulling this information together. The consultants who may be brought in to lend support, as well as other stakeholders that may be engaged as part of this process-so that the stakeholders can see and appreciate how they fit in to the larger context. I also think that regulators so that they could understand the impact of their decisions on the business. Because there are times in some industries where businesses do need to engage regulators in their business-planning process" (Respondent E2b-3).
- "I think a company could utilize it themselves, while consultants could use it as a teaching and business development tool" (Respondent E2b-4).
- "Managers [could benefit] because they're the ones doing it. Academics because, [they are] teaching, researching and studying it. And then, you know, for someone like me who is a consultant, you go, 'Okay, you know, now I have a structure and a framework for sitting down with someone and designing a comprehensive business model' " (Respondent E2b-5).
- "I think it's most useful to illuminate things that people do know about themselves, about their organizations. What I've found as a consultant is once you talk to three or four members of the senior executive team, you kind of know

more than they do, at a very high level, because they all know what they know, and they don't know what everybody else knows. So to some extent, this is the purpose I see of this modeling tool." "[It enables a] a deeper level of communication." "[If] I get a bunch of senior execs around the room, and they're pointing at different boxes, and saying 'Well, where am I? And what's happening here?' And once you have that conversation and you adjust the boxes, all of a sudden, they're all on the same page. And then you can move forward. Without that, they're thinking in their silo's, in their departments, or in their expertise" (Respondent E2b-6).

- "You know what this would be a very good tool for, developing a business plan and conceptually defining a new business. I see that if someone started now with all these right perspectives (impact on society, process, what is going to be done, how you're going to measure it, learning & development), that if I was starting a brand new business, a significant business today, I would use this business model to help me define and develop a pure detailed business plan" (Respondent E2b-7).

12. Respondents had a range of feedback on whether Overall Design Principle 2 had been met (ODP2, 3.5.1.5 Achieving the Generic Benefits of Ontologies with the Sustainable Business Model Ontology) and whether the SSBMO was equally useful to business model designers irrespective of their world-view:

- One respondent (E2b-3) lent direct support to ODP2, by restated this overall design principles as a pre-condition for business model designers to find the SSBMO to have high utility: "A system condition of this ontology that the business has an open mindset. […] The mindset of the design professionals, the mindset of the owner, the mindset of the occupants, the mindset of the investor. […In other words] the intention of the business [matters:] profit maximization [or] to integrate [the environmental and social] aspects."

  This respondent then went on to validate that the SSBMO does in their view take this open, empathetic approach, not requiring the business model designer to first adopt a strongly sustainable world-view to gain some value from the ontology: "it isn't overtly clear to me that in order to use this business model you must have a different intention"[15].

- Overall the respondents with a strongly sustainable world-view felt for business model designers who shared their world-view the tool would be useful and useable. However, when considering the reaction of business model designers with a profit-first world-view they tended to focus on the what they believed would be burdensome and unnecessary complexity of the SSBMO: "right now it's pretty simple for them [to design a profit-first business model]. They'd have to have a reason to care [before they would use the strongly sustainable tool]" (Respondent E2b-1).
- Connecting this to the feedback concerning the need to provide an introductory or highly summarized version of the tool to enable 'open minded' profit-first people to find the SSBMO useful, Respondent E2b-5 who has a strongly sustainable world-view stated, recognizing their somewhat pejorative language, "I think that a 'dumbed-down' version might be the way to-to introduce [profit-first] people to it."
- But even in this there was neither unanimity nor consistency of feedback from respondents with a strongly sustainable world-view. Respondent E2b-2 noted "I think that people from all walks of life will find this relevant and useful to them" and Respondent E2b-4 stated "I think the model could be used for both [world-views] – as understanding the broader impacts can help drive a for profit model."
- Perhaps respondent E2b-3 best summarized this dichotomous view of the respondents with the strongly sustainable world-view when they stated toward the end of the interview: "based on our earlier conversations about mindset and intention, I think on the surface, it would more useful to those on their

[15] The respondent, with a clearly strongly sustainable world-view, clearly felt this was not a good thing; his broader commentary lead to the understanding that they would have preferred a prescriptive tool!

interpretation of strong sustainability, than those who have a strong profit-first perspective. [But] if [the latter] have an open mindset and were prepared to explore the questions that this model asks, then it could be even more useful to that group than those that already believe in strong sustainability."

- However, somewhat contradicting this, one of the respondents with a profit-first world-view summarized it this way: "Some companies really wouldn't care the impact they have on society or the environment. So they would just ignore that piece. So I would think they would just de-value or value different aspects of it [compared to people who were attempting to be strongly sustainable], based on their [profit-first] perspective and what they are trying to gain". "I think if you're alive today, you understand that you have an impact on the environment. I just think that people, based on their priorities, would discount certain aspects of [the SSBMO], or would tend not to believe, based on their gain or their loss. No [, these people would not reject the use of the tool outright]."

13. Several respondents, but not a majority, had difficulty comprehending the difference between the social entities outside the boundary of a firm (Actor and Need) and the entities these are inter-related to inside the firm boundary (Stakeholder and Criterion, respectively). One of these respondents also felt the Decision entity was unnecessary. This drove the suggestion that a level of simplification was possible. The respondents who had this comprehension difficulty were those with a world-view closer to profit-first than strongly sustainable.

    In contrast one of the respondents with a strongly-sustainable world view stated "I loved the Actor and the Needs, because it makes you look at the extended stakeholders. Which people tend to fall down on." (Respondent E2b-5)

    However, the profit-first respondents highlighted how the biophysical entities, also outside the boundary of the firm were useful and necessary parts of the model: "On the biophysical, I think that's absolutely necessary. So it happens to be outside the firm box. I think that's an integral part of this model, and it has to stay, and it's brilliant. It's nicely done" (Respondent E2b-6).

These divergent responses appears to confirm that it is becoming common place to understand the relationship between firm sustainability and the biophysical world, but that the connection to social aspects continues to lag behind.

Interestingly it was a respondent with a strongly sustainable world-view who thought that people with profit-first world-views approaching the model might have difficulty with the terminology of bio-physical stocks and eco-system services, noting "you know, you do have to become familiar with the language. You know, and it's part of the journey. But, [currently] I tend to use 'nature,' 'natural'. So natural stocks instead of biophysical stocks. Or natural-nature services instead of eco-. But then again, you don't want to get too layman with the terms as well. So I know it's that balance that you're trying to find, right?" (Respondent E2b-5). This respondent then went on to note, as an example of how new useful terms come into common usage that a terms like "channel" and "stakeholder" would not have been familiar to profit-first business people 20 years ago, but now it is very familiar, as people incorporate the latest social scientific knowledge into their conception of a business model.

14. The experts were all familiar with definitions and use of organizational mission, vision and values statements. Further they all believed that the selection and operationalization of specific organizational culture, ethics and leadership styles strongly contributed to firm success. These concepts do not explicitly appear in the SSBMO; however, key antecedents are included (7.4.5.1). This was thought by a majority of the interviewees to be insufficient.

    For example:

    - One respondent (E2b-1) wanted the ability to directly record that a firm intended to meet all codified UN Human Rights. In contrast the SSBMO Measurement perspective suggests that success is defined in terms of related specific metrics, such as living wage (which is measurement of a UN codified human right). i.e.

since you ca not measure human rights in the abstract you need to determine how you would (attempt) to measure the firms adherence or achievement of such rights.

- Another respondent (E2b-5) asked “What about the soft stuff? So how do you measure the culture of an organization? How do you measure the engagement of employees? How do you measure, like, those soft things? So where would you put that?”
- Finally, in relationship to the example instantiation of the SSBMO, one respondent commented “You've put Timberland’s 4 goals [elements of Timberlands mission statement] on the model, which is nice, but they are not really part of the model’s ontology are they?” (Respondent E2b-6).

Related to this topic of defining success and its measurement, one respondent (E2b-6) thought that utility could be significantly increased if the acceptable definition of organization success, its “goals”, could be modelled as a separate entity, rather than as attributes in each of the Measurement perspective entities: “what’s important is goals and attainment of goals.” “Companies are not driven by business models; they’re driven by goals; and the ability to measure the performance of those goals.” “So the extent to which you can make this model very much integral to the attaining of goals, integral to thinking about goals, attaining goals, measuring goals, then I think you’ve got something very powerful that people might have behind their desk on a wall, as opposed to in a book somewhere” (Respondent E2b-6).

This same respondent, who has a profit-first world view, also had difficulty with the concept that value might be measured in non-monetary units and that some stakeholders might receive negative value. Indeed it was clear that this respondent’s definition of value and its measurement was inseparable from monetary units: “What does value mean in non-monetary [terms]? […] Everything has value, including quality. […The words non-monetary] are tricky for me”.

Several respondents (though not the majority) noted how our knowledge and ability to do measurement calculations, whether in units applicable to each context generalization, or converting all measurements to monetary units were "still hard to nail down" but yet "making these calculations is the most important element of the model – is to bring in the value of the various elements" (Respondent E2b-4).

One noted that the "power" of the model is reduced because of this difficulty: "[The] measurement box is a bit of a mess at the moment. It needs-this is the nub of where-this is really one of the crux places where you [need to] bring in the 'tri perspectives,' the three perspectives. At the moment, it's not-doesn't have the power that it should have […] I would say, generally speaking, the whole community around sustainability is still struggling with-with that issue. And I'm not different from that. You've just taken another-another kick at that can, if you like" (Respondent E2b-6).

15. Metric M10 (Elegance) was criticised by a number of respondents as not being clearly enough defined (Table 6-23). Several respondents suggested it should have two components which they described as "technical" or "intellectual" elegance and "aesthetic appeal".

16. Respondents were all convinced of the technical or intellectual elegance of the SSBMO and the SSBMC it powers:

- "I would say yes, it's elegant, in my definition because I'm a visual learner and so I can see that, yes" (Respondent E2b-1).
- "Definitely elegant" (Respondent E2b-2).
- "I think it is intellectually elegant. I'm fascinated by it because, for a long time, this is how I think. And it's interesting to see it presented in a way that is so intellectually elegant and simplified, not simplistic, because it's not simplistic" (Respondent E2b-3).
- "I found the tool very straight forward and easy to follow- but that may be because I understand what it is trying to achieve. However, I think it simplifies it

in such a way that a company can pull these elements into bite sized pieces that when put together gives the big picture of action" (Respondent E2b-4).

- "I would say it's-technically, it's elegant, it's very elegant" (Respondent E2b-5).
- "It has technical elegance, it describes the company, it puts things each in its own box. So if I need to find something, I know where to go to." "I can conceptually get my brain around what the Timberland company is doing. And I know where to go to find my answers" (Respondent E2b-7).

Several respondents commented that the SSBMC was much more intellectually elegant than the SSBMO, as they could see how people could engage with it: "I think it's extremely elegant. […] You know, whether it's a simple chart that you give away, or whether it's an app or something, but something that a beginner [can follow a simple process to use it, i.e.:] Step 1, put in this. Step 2, do this. Whereas I feel, when I look at the ontology, it can be a little bit overwhelming. Because, appropriately business is overwhelming. But I think that, you know, if you create some sort of an incarnation of this, [the canvas] can be extremely elegant and useful" (Respondent E2b-2).

17. Respondents were more reticent about offering their opinion on the artistic elegance of the SSBMO and SSBMC, but those who chose to offer an opinion had a range of opinions:

- "I thought it was visual and spatial" (Respondent E2b-1)
- "Well, yes, it is aesthetically elegant. [But] I think there's room for improvement. The use of stickies with the writing that looks handwritten is interesting because it's often how some people think in analogue, right? The old-fashioned way. But

for some audiences, I think it's too rough. It could be more polished" (Respondent E2b-3)[16].

- "I'm good with the aesthetics." "The visualization is good. The colours and sticky notes are good. The kind of physical-sense side of this" (Respondent E2b-6).
- "I like the colours [chuckling]" (Respondent E2b-7).

18. As another dimension to usefulness (M9) respondents were asked at the end of the interview if they would like to know more about the SSBMO: if they responded yes this indicated they thought it had enough utility to warrant a further investment of their time (item E2b-Q-C-2). All the respondents not only answered yes, but were keen to keep up the dialogue in bringing the SSBMO to market; one expert joined the OCADU sLab Strongly Sustainable Business Model Group (8.6.2.4). Other interviewees have subsequently proactively contact the researchers to continuing the dialogue about the tool.
19. Finally respondents where asked if they had any other comments on the SSBMO or the process used to build or evaluate it:
    - "I thought it was a very good first start and that the underlying principles were sound" (Respondent E2b-1).
    - "It's a lot of effort been put into it and the methodology that you used is amazing; the level of research that you've done is extraordinary, so congratulations" (Respondent E2b-2).
    - "This is an impressive body of work so far. I think one thing that makes it impressive is you're building upon the work of another. You're not saying that Osterwalder's work is incorrect or wrong; you're saying that that's a good model that seems to be gaining acceptance and popularity. And let's add to that to make

[16] Interesting this directly contradicts the advice received from a graphic / design communications professional of many years experience who suggested making things look hand drawn makes them seem more accessible and less daunting, and therefore easier for people to relate to! (5.7.1.3)

it more comprehensive. But you're adding to it not in a bolt-on fashion. You're integrating, which I think is a very, very important aspect and consideration of this work and your approach to the work" (Respondent E2b-3).

- "Overall, I like the tool and think it provides a great way to analyze a company" (Respondent E2b-4).
- "I think it's great. I think you're doing a good job. I think it's, you know, about time somebody did something like this. And you're being extremely rigorous. I think you've really thought about it. And I like that you're basing it on something that's already accepted. Not necessarily reinventing the wheel, just innovating the wheel a little bit, which is great" (Respondent E2b-5).
- "I think the promise of this approach is very exciting. The model itself adds to our existing understanding of business models, specifically adding in the elements needed to model environmental and social contexts. This is a good start" (Respondent E2b-6).

8.7.3.3 Evaluation Hypothesis

Considering the relevant evaluation hypotheses in light of these 19 findings (6.6.2.7):

E2b-EH1: ***Not confirmed***. Summary of evidence from findings:

> Despite their stated world-views, the respondents with the profit-first world views almost seem more convinced of the utility of the SSBMO than the respondents with the strongly-sustainable world-view.
>
> This appears to be because profit-first respondents recognize, at some level and in some way, the legitimacy of the need to consider objectives other than monetary profit. They see the SSBMO and the SSBMC as a welcome approach to starting this learning journey.
>
> On the other hand, strongly sustainable respondents believe that any non-profit oriented elements introduced into a discussion of business models will be rejected by

profit-first business model designers. This rejection is due to the increases in complexity and the introduction of unfamiliar concepts and relationships. This causes people with a strongly sustainable world-view to perceive the SSBMO as less useful overall than profit first respondents.

In summary, all respondents agreed the SSBMO would be useful to people with a strongly sustainable world-view; but only people with a profit first world-view consistently embraced its utility to people like themselves!

Reflection on this somewhat curious finding, this is either a very positive development, or the respondents with a strongly sustainable world-view had a better understanding of the real behaviours of people with a profit-first world-view than this group had of themselves!

8.7.3.4 Metric Values

Overall the 26 items used to gather the comparator knowledge K4 and K5 were each asked 7 times leading to 140 responses / answers[17]. These responses, summarized in the findings above, led to:

1. A range of confirmatory feedback. Following analysis and synthesis of each response, of the 140 total responses

   - 4 (3%) were determined to indicate the respondent is ***unsatisfied*** with the SSBMO or the example instantiation (shown using the SSBMC).
   - 106 (76%) were determined to indicate the respondent is ***satisfied*** with the SSBMO or the example instantiation (shown using the SSBMC).
   - 30 (21%) were determined to indicate the respondent is ***highly satisfied*** with the SSBMO or the example instantiation (shown using the SSBMC).

   In turn these determined levels of satisfaction were used to determine the confirmatory feedback values of each of the 9 metrics reported in Table 8-10.

2. The identification of 33 items of feedback: opportunities for improvement. These opportunities for improvement are also described below in Table 8-10. In turn these opportunities led to the identification of the gaps in utility and gaps in research rigor, described after the table.

[17] Not all interviewees responded to all items.

Table 8-10 presents the values of the nine metrics whose values were determined based on the responses / answers of the seven expert interviewees, as summarized in the above findings.

Metric		Value: Confirmatory Feedback	Value: Opportunity for Improvement
M4a	Completeness (Related to Reliability in Describing Business Models)	Satisfactory	– Represent a business model at a point in time, over and through time – Improve the representation of the inter-relationships between the constructs – particularly between the generalization and specific entities – Make the model dynamic; by allow empirical prototyping and simulation. – Explicitly represent concepts of an organizations mission, vision and values (culture, ethics, rights, leadership style) – Need to explain how CSR conceptions of sustainability can be modelled and the gap between such conceptions and an integrated achievement of environmental, social and economic profit – Need to provide advice on how to define and achieve success (i.e. connection between world view and understanding of materiality of, particularly environmental and social success metrics)
M5	Level of Detail	Satisfactory with minority finding it to be Highly Satisfactory	– Ability to tell the story of reasons or logic of firm success or failure by describing large vs. small gaps for each instance of each entity to either the designed importance to achieving, or actual performance to achieving, existing and desired goals.
M6a	Comprehens-ibility (Related to Reliability of Describing Business Models)	Satisfactory or Highly Satisfactory – respondents split equally	– Label for Decision, Capability, and Value Configuration entities are not commonly understood without significant explanation. – Difference between and relationships in between Actor & Need and Stakeholder & Criterion not well understood by persons with world-view closer to profit-first. – Need process for use – including an explanation of how to analyse, design and design the external economic market positioning of a firm

Metric		Value	
		Confirmatory Feedback	Opportunity for Improvement
M6b	Comprehensibility (Related to Efficiency of Use)	Satisfactory	– Need an even more summarized view to get people interested in engaging with detailed views (providing by existing visualizations) – Visual representations not sufficiently accessible
M7	Real-World Likeness	Satisfactory with minority finding it to be Highly Satisfactory	Only that first highlighted by feedback related to other metrics above
M9	Useful	Satisfactory with minority finding it to be Highly Satisfactory	– Need process for use
M10a	Elegance (Technical)	Satisfactory with minority finding it to be Highly Satisfactory	Only that first highlighted by feedback related to other metrics above
M10b	Elegance (Aesthetic)	Satisfactory	Only that first highlighted by feedback related to other metrics above
M11	Easy to Use	Satisfactory	Only that first highlighted by feedback related to other metrics above

Table 8-10: Value of Metrics of 3rd Party Expert Review Activity – Formal (E2b, M4-7, M9-11)

8.7.4 Gaps

The determined metric values (Table 8-10) highlight the following gaps in artefact utility from evaluation activity group E2b:

GU7: Concepts of mission (goals), vision, and values (culture, ethics, rights, leadership and decision making style) are inherent in the constructs within the Measurement and other perspectives (7.4.5.1). However, the familiarity of respondents with this specific terminology suggests that their omission (or at least a lack of an explicit explanation of how they relate to constructs in the SSBMO), reduces utility. The experts expected these concepts to be included what they understood by a business model; their omission was unexpected and hence set up a barrier to engaging with the tool.

While not identified as a designed limitation of this research (2.6), it is note worthy that the BMO has the same limitation, as described in the first three rows of Table 4-11.

GU8: Find a better way to address the relationships between the constructs in summary (SM3) and overview (SM5a) visualizations.

GU9: Find a better way to provide a more accessible introductory visualization.

GU10: Determine better labels for Decision, Capability and Value Configuration entities.

GU11: Determine a mechanism to record the information necessary to tell the story of why an organization is successful or not, i.e. the logic that connects instances of entities to success or failure: the why of organization success or failure. This would include the ability to describe large vs. small gaps between each instance of each entity to either the designed level of importance to, or actual performance to, achieving the organizations definition of success.

While not identified as a designed limitation (2.6), it is note worthy that the BMO conceptually has this same gap, as described in the third row of Table 4-11.

Note that the following opportunities for improvement of the SSBMO and SSBMC identified in Table 8-10 are designed limitations of this research (2.6):

L1: Changes to a business model over and through time, including the modelling of dynamic aspects of business models

L4: The ability to design a business model, for example via empiric modelling, prototyping and (dynamic) simulation.

L4, **L6**, **L7**: Any use of this tool in a design mode, any process (method) to design strongly sustainable business models, or any design principles for strongly sustainable business model design. However, respondents noted the possibly significant increase in SSBMO utility that overcoming these limitations would make. Respondents made the following suggestions in this regard:

1. Explain:
   - How CSR conceptions of sustainability can be modelled and the gap between such conceptions and the integrated achievement of environmental, social and economic profit.
   - The concepts behind the visualizations used – e.g. box size and positioning with respect to each other (7.3.2.5, 7.4.1.2, 7.4.1.3).
   - Relationships and definition of Actor & Need and Stakeholder & Criterion (particularly for profit first business model designers).
   - A summary description of each entity and their inter-relationships
     - "I would have appreciated almost, I hate to say it, a slide on every box, and how they connected to the other boxes, to say this is what we mean by this and this is how it connects and this is why we put the relationships the way – it's almost like I needed that" (Respondent E2b-1).
     - "So I think it's a good piece of feedback that the direction of the lines and whether or not they're bidirectional or one-directional, and what the lines actually mean is actually important" (Respondent E2b-5).
2. Provide advice on:
   - How to define success, i.e. connection between world-view and an understanding of the materiality of, particularly environmental and social success metrics (Respondent E2b-1).
   - How to use SSBMO and SSBMC for "external" analysis – i.e. how to use it to scan the bio-physical, social and economic/market contexts. In the latter regard it might complement Porter's 5 forces model (Porter, 1985).
   - Best practices to define and achieve success, i.e. links to other standards and models. e.g. for Decision and Stakeholder entities pull design principles from the International Association for Public Participation Public Participation Spectrum

guidelines (IPA2). "So broadly, my observation is where do you link to other models that could be useful in a whole variety of boxes? You know, I'm sure we could have a lengthy conversation about models in the 'ecosystem service' box. And then, specifically for the decision box, I wanted to bring to your attention this IAP2 model." (Respondent E2b-3).

- Proven patterns of successful strongly sustainable business model designs.
- The process for effective and efficient use, i.e.
  - Prepare several "as is" models by business unit, product or goal; then several "to-be" models; then do a comparison to identify gaps; formulate ways to dissolve (not trade-off) these gaps, and formulate action plans (Adapted to strongly sustainable world-view from comments by Respondent E2b-6).
  - "The CEO's going to ask me [after seeing the model], so what do we do next" (Respondent E2b-5).

The determined metric values also highlight the following gaps in research rigor:

GR6: Definition of 7 on scale of Profit-First to Strongly Sustainable used in items E2b-Q-DG8 and E3-Q-DG-7a..d was changed from "balance achievement of environmental, social and economic goals" to "integrating achievement". Since this feedback was obtained in the first interview, this terminology was then used when asking this question to all other respondents.

GR7: Definition of Elegance (M10), split into two: "technical" or "intellectual" elegance and "aesthetic appeal" in all items in E2b and E3. Since this feedback was obtained in the first interview, this terminology was then used when asking this question to all other respondents.

GR8: A minority of the opportunities for improvement identified by respondents were due to misunderstanding or misperception of various aspects of the SSBMO and example instantiations.

8.7.5 Conclusions on Results of Evaluation Activity Group E2b & E4

The overall purpose of this evaluation activity group was to formally gather external feedback on the final iteration of the SSBMO design (final output of build activity group D3), adding more 'second-order' feedback to the informal external feedback gathered during evaluation activity group (E2a) (6.4.9.4, 6.6.2).

From this perspective this evaluation activity achieved this goal and gave further confidence that the final design as conceived would be able to provide:

- Sufficient utility to the case study participants to make it likely they would consider their involvement valuable, and
- Sufficient utility to business model designers in general to entice them to use the SSBMO.

8.8 Result of Case Studies (E3 & E4)

8.8.1 Introduction

The detailed design for this evaluation group is introduced in 6.4.9.1 and 6.4.9.5 and set out in detail in 6.7. The intention is to determine values for metrics M4 (Completeness), M6 (Comprehensibility), M9 (Usefulness), M10 (Elegance) and M11 (Easy to Use), and to report on evaluation hypothesis E3-EH1.

8.8.2 Respondent Demographics

Table 8-11 compares the expected and reported world-views of the two case studies undertaken (Table 6-45 sets out expected values and other demographic information). The reported values where gathered through items E3-Q-DG-1 & 7a-d.

Case ID	Reported / Assessed Role[18]	Expected World-view*	Reported Personal World-View*	Reported World-View of their Company Today*	Reported World-View of their Company 5 years Ago*	Reported World-View Desired for their Company 6 years Hence*
E3a	Founder / Owner / Leader	6-7	7	6	5	7
E3b3	Owner / Leader / Manager	3-4	7	5	5	6

* 1 = aggressively profit first, 4 = Neutral, 7 = aggressively strongly sustainable

Table 8-11: Comparing Expected and Reported Case Study Basic Demographic Information

The 2nd case respondent (E3b3) rated their world-views higher than expected. It is clear from this firm's business model that they were taking considerably fewer actions which are aligned with the working definition of organizational strong sustainability compared to the first case. Hence the desired cohort validity and variety as per the evaluation world-view and triangulation requirements for the first two cases was achieved (6.3.2.2, 6.7.1.5).

In addition, other demographic information was gathered to understand the baseline knowledge of the case respondents using items E3-Q-DG3, 5-6 (Table 6-49). Table 8-12 summarizes this information that concerns the respondent's understanding of the term business model, the importance to business success that the respondent placed in business models, and their role in new product or service design. All questions were asked on 7 point scales, summarized in the footnotes.

[18] For confidentiality reasons titles are not included.

Case ID	Respondent's Definition of the term "Business Model"	Importance of Business Models and Modelling to Firm Success[19]	Respondent Level of Involvement with New Product or Service Design[20]
E3a	"What a company makes, seeks to do, who owns what"	7	7
E3b3	"The way we run our business"	6	7

Table 8-12: Baseline Knowledge of Case Respondents

Based on the knowledge of the case respondents gained during the case study process (6.7.2) it is clear the case respondents understanding of the term business model, were broadly aligned with both the working definition and the literature (4.5.5).

Finally, together all this demographic information supports the values of the contextual metrics presented in Table 8-2. It was clear from the demographic information gathered that the case respondents felt business models were important to their organizations success, and therefore a tool to help them more efficiently produce high quality (strongly sustainable) business models would be important (M3) and desirable (M2), i.e. they thought the research question (RQ) was valid.. Further there was a high or very high expectation (M1) that what would be presented to them would useful[21].

[19] Scale: 1-7 – 1 = always unimportant, 4 = can be important, 7 = always very important
[20] Scale: 1-7 – 1 = never involved, 4 = involved in some small initiatives, 7 = involved in all large initiatives
[21] Case respondent E3b3 made this point explicitly: "I remember I was sitting in the car when my kids were at their music lesson, I was talking to you [to set-up the case study process]. And I was going, 'Oh, do I really want to do this?' Right? But then, you know, I don't know, there was something in the conversation, and I said, 'You know, you know I can learn something more about who [we are as a company]."

8.8.3 Results

8.8.3.1 Introduction

The protocol described in 6.7.2 resulted in the comparator knowledge sources described in 6.7.1.4:

- Knowledge about the case firm's business models (K6-D, K6-E)
- Descriptions of the case firm's business model described using both a tabular form of the SSBMO (5.4.7, similar to SM6a[22]) and post-it notes on the SSBMC (5.4.8, similar to SM7) (K6-BM)
- Knowledge and opinion whether there is recognition, fit or likeness of their firm's business model to the description of that model described using the SSBMO (K6-E).

As a reminder of a detail of the case protocol: unlike the 3rd party expert protocol used in evaluation activity group E2b, neither the SSBMO nor SSBMC was explained to the case respondents. No explanation of the boxes, relationships, method used to create it, its relationship to the BMO, nor justification of the choices made was provided. This was deliberate in order to better gather responses on all metrics based solely on respondent's knowledge and opinion.

Instead the respondents reacted to a ~1 hour presentation of their firm's business model expressed using the wall sized SSBMC (SM5c) and post-it notes (5.4.8, similar to SM7). During this presentation, as each post-it note was placed on the SSBMC that element of the case firms business model would be explained (and obviously this included a very brief explanation of the reason for placing it in a given location on the SSBMC). A brief description of the case firm's business model expressed using a tabular form of the SSBMO (5.4.7, similar to SM6a) was also provided. Copies of both expressions of the case firm's business models were left with the respondent for them to reflect upon for a number of days prior to conducting feedback interview.

[22] For reasons of confidentiality the case firm's business models described using the SSBMO and SSBMC are not included. They are conceptually identical to the examples of The Timberland Company (SM6a and SM7).

For the reasons noted in 8.3 the construction of comparator knowledge source K1, based on a CATWOE analysis of K6-BM was not undertaken (6.7.1.7).

8.8.3.2 Findings

Analysing these comparator knowledge sources against the expected, desirable and importance of a highly useful example instances of the SSBMO (the case firm's business models, K6-BM) (M1-3), 11 findings are apparent:

1. One of the case respondents (E3a) was familiar with the BMC and had found the concept of modelling their business model of enough value that they had previously used the BMC to describe their business model. However, due to their strongly sustainable world-view this respondent had found it necessary to adjust the BMO to represent their understanding of their business model.

   This lends support to the identification of the overall problem to which this research is directed: existing conceptions of business models are insufficient to represent strongly sustainable firms (2.1). "I know I had to amend the Osterwalder [model] quite a bit, because it didn't have categories for other things. So I think you're right from a social-business[23] point of view".

   This respondent went on to strongly agree with the researcher's statement: "Sometimes what we have to recognize is that people take more than one stakeholder role. […] There's lot of subtlety in this interaction. Again, if I compare this to Osterwalder's BMC, which only conceives one type of stakeholder, which is customer. I think that's actually a limitation, even if you don't care about strong sustainability".

2. Despite the expert interviewees concerns about the complexity of the SSBMO and SSBMC, both case study participants clearly demonstrated their ability and willingness to engage, reason with and provide meaningful feedback on the

[23] This was the terminology this respondent preferred to "strongly sustainable". It was clear from context, and the responses to the demographic questions there was a high degree of alignment of the meaning of these terms.

description of their firm's business model expressed using the SSBMO and SSBMC. This despite almost no description, explanation or justification of the basis for the ontologies and the expression of their business model being provided (8.8.3.1).

Respondent E3a stated "it's interesting because what we've done is pulled out all the detail of the business and then put it under the categories. And that's great."

Respondent E3b3 stated "Yes, I recognize this firm." "This really does get at who we are, which is really interesting because it's a business, you know, it's not a live thing. This gets the zeitgeist of who we are really, which is great." "Basically, putting all the pieces together on the same piece of paper, well, figuratively speaking and literally speaking. I think that it's the clustering probably of the information that helps".

This is not to say that case respondents would not have derived more utility had more explanation been provided, as respondent E3a stated: "certainly all the little stickies describe pieces of the business, [but] I struggle with the labels". However, this respondent, with a strongly sustainable world-view noted that perhaps their problem with the labels was that "I've had [a neo-classical] business-school training, so maybe some of my language is entrenched in my head because of that. I was taught in a certain way".

However, case respondent E3b3 found sufficient utility in the explanation of their firm's business model that they thought a consultant offering a service to simply prepare descriptions of business models using the SSBMO should charge at least $10,000 since "[the SSBMO describes] who we are. I think that gives you a lot of credibility because I think very few people figure out who [a firm is]". This same respondent opined that a service which then offered diagnostic and redesign services based on these descriptions would be even more valuable.

3. Case respondents also found the context generalizations a contribution to their understanding of their own business model: "as far as the model goes, you've got the

environmental context and the social context in there. Most business models just actually do the internal stuff that you've got there. So that's good" (Respondent E3a).

4. Case respondents found understanding the inter-relationships between the concepts described on the post-it notes hard to follow: "It doesn't show how the pieces are related to each other." "it's almost [that you] have to know the business in order to know what the relationships are. And so it's not documenting the relationships directly on [the canvas]" (Respondent E3b3).

   It is unclear if this is a weakness of the SSBMO or a limitation of the research protocol. As can be appreciated from the description of the inter-relationships between the entities of the SSBMO (Chapter 7) considerable depth exists in these relationships.

   To work through these relationships in the case firm's business model the researcher had spent some tens of hours first building a tabular form of each firm's business model (5.4.7, similar to SM6a) from all the data provided (KM6-E, KM6-D) and then preparing a summary form using post-it notes on the SSBMC (5.4.8, similar to SM7).

   However, only an hour was used to present this work to the case respondents. So necessarily much of the knowledge gained by the researcher about the relationships of elements of each case firm's business model was not communicated to the case respondents. The knowledge of the inter-relationships of the elements of each case firm's business model however was captured in the tabular form of instantiation of the SSBMO describing the case firm's business model.

   As commented by several of the expert interviewees, if the respondents had been involved in the process of building the representation of their business model, this challenge may have been largely overcome (8.7.3.2, Finding #10)

5. The case respondent with the less strongly sustainable world view tended to agree with the expert interviewees with profit-first world views concerning the inability to

describe ideas of Corporate Social Responsibility to the concepts coded in the SSBMC (8.7.3.2, Finding #6).

6. Case respondents found the same gaps identified by the expert interviewees (8.7.3.2, Finding #10): the example instantiations of the SSBMO were not useful for:

    - Understanding or describing economic market position (i.e. external analysis of a firm): “one of the things the chart doesn’t address, at least I can’t see in here-how my business is a boutique business, per say.” “it doesn’t take into account [any] position in the market” (Respondent E3a).

    - Identifying strengths, weaknesses or in prioritizing opportunities for improvement: “problems didn’t jump out at me”, “[The post-it notes are] all valid things. And then you go, ‘But they’re-they can be weighted very differently, or, you know, they have sort of different importance’ ” (Respondent E3b3).

7. Case respondents found the same gap as the expert interviewees concerning the need for an even more summarized view of a business model compared to the SSBMC (8.7.3.2, Finding #10): “Some places call it a value proposition. Some people say, basically, what [they do]-in an elevator ride-‘what the heck is it that you do?’ And then all of the [detail shown on the SSBMC] are how you do it and for whom. So I think that [summary] could be made more visual somehow” (Respondent E3a).

    However this respondent also noted that “[the SSBMC] is simple when, I guess, you take out all the stickies”, but that showing the SSBMC with the stickies already on it would be complex to explain to a colleague “I would have to spend a lot of time explaining the model and how all the pieces work, and then on top of that, spend time on [our] business model. So if I were using this to explain a business to a [colleague], investor or a bank, I would probably need to simplify it a little bit”.

    However, building on the theme of the utility of a further simplified view of the SSBMC this respondent also stated that such a simplification “could be very useful […] when you’re dealing with investors, or bankers, or even just doing a presentation on your business". "That's why I liked [my amended version of Osterwalder's BMC]: it allowed me to say, 'this is what we're all about. Now let's drill down' ".

Contradicting this perspective respondent E3b3 stated "I found the most useful way [of using this description of our business model] was telling our own people who we are, rather than telling other people, outside stakeholders. So more for internal stakeholders to give a big-bigger picture of who we are, because it does, I think, capture a pretty good picture. I'm just thinking, you know, you bring on a new hire and you go, 'Okay, what's [this company] about?' "

Further this respondent thought the lack of applicability of the SSBMO to external stakeholders was due to those stakeholders' lack of interest in many aspects of a business model described by the SSBMO, and not due to a weakness or omission of the SSBMO. This is a common profit-first perspective: it is generally assumed all firm's care about other firms is selling to them at the highest monetary price, and buying from them at the lowest monetary price.

Respondent E3a also thought that while the SSBMC was a good descriptive tool and good for detailed design, this tool would be too complex to be used at the start of a strongly sustainable business model design process: "You'd have to start with a simpler model and then work your way deeper, if you're trying to communicate to investors, for example, what it is you're trying to do, and how you do it".

8. Case respondents also found the same gaps as the expert interviewees concerning the representation of culture (8.7.3.2, Findings #14) and had the sense that there was some connection between decision making processes and culture: "Then stuff like this, 'decision-making,' I think is more a culture thing, you know? […] I would say decision-making is really around culture. And that maybe should be a box by itself. [… Culture] is hugely key to social-enterprise. Because you want the culture to be cohesive. And you want the culture to be consistent with the kinds of things you're trying to achieve. So if you're trying to achieve social justice stuff, it would be not

very good for you to be autocratic, internally and not live out those things internally" (Respondent E3a).

9. Respondent E3b3 thought the representation of their firm's business could be useful to help them ensure they were authentically, accurately and consistently communicating about the firm: "I think it's very useful to give management a window into how the outside world sees who we are and how we work. And therefore [it] provides the opportunity to realign our communication goals, metrics, with who we want to be or who we think we want to be. And certainly, how we want the market to see who we are".

10. Reacting to the aesthetic elegance of the SSBMC:

    - Respondent E3a, who had experience as an art director, stated:

        - "[You need to be] very careful about how you use your colours and be consistent about what those colours mean. Maybe you've had to think about that. For example, you've got 'the environment' that's green, 'society' pink- that's fine. Financial, blue is great for 'financial economy,' because blue means (all colours have meaning, right?) stability. There's reasons why banks and corporations use blue."

        - "What if you made it more organic? Rounds, circles. Squares are very square. Can you make it a little more organic?"

    - Supporting feedback from the expert interviewees, Respondent E3b3 stated "I think [the SSBMC] is stimulating. And I think [it helps] you pay attention" "I think the stickies approach was very good, very good. I really like it".

11. As another dimension to usefulness (M9) respondents were asked at the end of the interview if they would like to know more about the SSBMO: if they responded yes this indicated they thought it had enough utility to warrant a further investment of their time (item E3-Q-C-2). Both case respondents thought the SSBMO had enough utility to warrant further investment of their time:

- Respondent E3a stated they would attempt to use the blank SSBMC (SM5c and SM5c) to prepare a business model of a firm they were thinking of acquiring.
- Respondent E3b3 stated "I'd love to see the next [iteration]. I'd love to be involved. Totally happy to be involved, and whatever input you need, I'm happy to be the guinea pig or the sounding board, all that stuff. Because I think you've got it."

8.8.3.3 Evaluation Hypothesis

Considering the relevant evaluation hypotheses (E3-EH1, 6.7.1.9) in light of these findings insufficient data was gathered to respond, due to lack of third, profit-first case (E3c, Table 6-45).

8.8.3.4 Metric Values

Overall 12 items were used to gather the comparator knowledge K6-E once the respondents had been shown their firm's business model described using both a tabular form of the SSBMO (5.4.7, similar to SM6a) and post-it notes on the SSBMC (5.4.8, similar to SM7). Hence the items were each asked twice leading to 17 responses / answers[24]. These responses, summarized in the findings above, led to

1. A range of confirmatory feedback. Following analysis and synthesis of each responses, of the 17 total responses
    - 1 (6%) were determined as indicating the respondent is ***unsatisfied*** with the example instantiation of their firm's business model
    - 11 (65%) were determined as indicating the respondent is ***satisfied*** with the example instantiation of their firm's business model.
    - 4 (24%) were determined as indicating the respondent is ***highly satisfied*** with the example instantiation of their firm's business model.

[24] Not all case respondents responded to all items.

- In one case there was insufficient data gathered to make a determination of a value for a metric.

  In turn these determined levels of satisfaction were then used to determine the confirmatory feedback values of each of the 6 metrics reported in Table 8-13.

2. The identification of 12 items of feedback concerning opportunities for improvement. These opportunities for improvement are also described in Table 8-13. In turn these opportunities led to the identification of the gaps in utility and gaps in research rigor (described after the table).

Table 8-13 presents the values of the six metrics whose values were determined based on the responses / answers of the two case respondents, as summarized in the above findings.

Metric		Value	
		Confirmatory Feedback	Opportunity for Improvement
M4b	Completeness (Related to Efficiency in Describing Business Models)	Satisfactory	– Ability to tell the story of reasons or logic success or failure by describing large vs. small gaps for each instance of each entity to either the designed importance to achieving, or the actual performance to achieving, existing and desired goals – Explicitly represent concepts of an organizations culture and decision making style
M6b	Comprehens-ibility (Related to Efficiency of Use)	Satisfactory with minority of responses finding it to be Highly Satisfactory	– Need an even more summarized view to get people interested in engaging with detailed views (providing by existing visualizations) – Need process for use – including an explanation of how to analyse, design and design the external economic market positioning of a firm – Need to explain how CSR conceptions of sustainability can be modelled and the gap between such conceptions and an integrated achievement of environmental, social and economic profit
M9	Useful	Satisfactory with minority of responses finding it to be Highly Satisfactory	Only that first highlighted by feedback related to other metrics above
M10a	Elegance (Technical)	Insufficient Data	
M10b	Elegance (Aesthetic)	Satisfactory	Only that first highlighted by feedback related to other metrics above
M11	Easy to Use	Satisfactory	Only that first highlighted by feedback related to other metrics above

Table 8-13: Value of Metrics of Case Study Activity (E3, M4, M6, M9-11)

8.8.4 Gaps

The determined metric values from evaluation activity group E3 (Table 8-13) lent support to the following gaps first identified during evaluation activity E2b:

GU9: Find a better way to provide a more accessible introductory visualization.

GU11: Determine a mechanism to record information necessary to the tell the story of why an organization is successful or not.

No additional gaps in artefact utility were identified.

As described in 8.7.4, several of the opportunities for improvement of the SSBMO and SSBMC identified in Table 8-13 are designed limitations of this research (2.6). The case, respondents confirmed the feedback from the interviewees that possibly significant increases in SSBMO utility could be possible if these limitations were overcome.

Further, the determined metric values also highlight the following two additional gaps in research rigor:

GR9: The lack of the 3rd profit-first world-view case study reduced the ability to validate that ontology Overall Design Principle #2 (ODP2), had been fully adhered to. Further there wasn't sufficient data to respond to the evaluation hypothesis (E3-EH1).

GR10: For useful values of these metrics to be gathered using the CATWOE technique in a design science research project requires the involvement of 3rd parties unrelated to the artefacts or the process of their creation.

8.8.5 Conclusions on Results of Evaluation Activity Group E3 & E4

The overall purpose of this evaluation activity group was to formally gather external feedback on the final iteration of the SSBMO design (final output of build activity group D3), adding more 'second-order' feedback to the external feedback gathered during evaluation activity groups, E2a and E2b (6.4.9.5, 6.7).

Specifically the completeness, comprehensibility, elegancy and utility of the SSBMO was tested with respondents who were not briefed on any aspect of the basis for the ontology; respondents were only exposed to the SSBMO through an instantiation which described their firm's business model using the SSBMO and SSBMC (8.8.3.1).

Hence this was a considerably tougher evaluation than the one carried out in evaluation activity group E2b. In evaluation activity group E3 to obtain satisfactory scores on the metrics required that the constructs and relationships captured and coded by the SSBMO aligned, without explicit explanation, with the respondents' understanding of these elements.

In other words, this evaluation activity group attempted to determine whether the SSBMO lived up to a key requirement of generic ontology utility: that, as per the definition of a useful ontology, it "disambiguates and provide a consensual [shared] conceptual vocabulary, on which one can build descriptions and communication acts" and hence "more than one person must agree to the proposed ontology for it to be useful" (3.5.1.3 Purpose and Benefits of Ontologies).

From this perspective this evaluation activity showed, at least for these respondents, that this key benefit of ontologies was true in the case of the SSBMO when used to express the case firm's business models using the SSBMC. This somewhat refutes the concerns the expert interviewees expressed during evaluation activity group E2b about the complexity of even the visually simplified SSBMC getting in the way of its utility. In this activity group even less explanation was provided, and yet the respondents were able to recognize and reason with the description of their firm's business model expressed using the SSBMO.

In addition this evaluation activity lent further weight to the results of evaluation activity group E2b, giving further confidence that the final design as conceived would be able to provide a reasonable level of utility to business model designers in general.

8.9 Comparing Results to Research Question and Objective (E4)

Having determined values for the metrics based on each evaluation activity group, this section, uses these metric values to report on whether the research question (RQ), and research objectives (RO) have been met (2.2):

> To what degree has the research question (RQ) been answered and why?
>
> To what degree has the research objectives (RO) been met and why?

As a first step in responding to these two questions, Table 8-14 updates Table 8-1 to include the summarization of the determined metric values from evaluation activity groups E1-E3.

Research Objective		Aspect of Utility	Metrics		Summary Metric Values	
					Confirmatory	Opportunity for Improvement
RO0	Rigor	Context	M1	Expectation	High	GR1-11
			M2	Desirability	High	
			M3	Importance	High	
RO1a	Reliability	Completeness	M4a	Completeness (reliable)	Satisfactory	GU1-6
			M5	Level of Detail	Satisfactory – Highly Satisfactory	GU8
		Quality	M6a	Comprehensibility (reliable)	Satisfactory – Highly Satisfactory	GU7, GU9, GU10
			M7	Real-world Likeness	Satisfactory – Highly Satisfactory	None
RO1b	Consistency	Quality	M8	Internally consistent	Satisfactory	None
RO1c	Effectiveness	Generic	M9	Useful to user	Satisfactory – Highly Satisfactory	GU9, GU11
		Beauty	M10	Elegance (technical, aesthetic)	Satisfactory	None
RO2	Efficiency	Completeness	M4b	Completeness (efficiency)	Satisfactory	GU1-6
		Quality	M6b	Comprehensibility (efficiency)	Satisfactory	GU7, GU9, GU10
			M11	Easy to use	Satisfactory	GU9, GU11

Table 8-14: Evaluation Metric Values for each SSBMO Research Objective
(Summary of Tables 6-22 and 6-23, updated in light of findings)

The results presented in Table 8-14 suggests that while there is clearly room for improvement in research rigor and artefact utility, and while the designed limitations (2.6) clearly impact artefact utility, overall the SSBMO does appear to meet the research objective (2.2):

RO: The designed artefacts increase the quality (reliability, consistency, effectiveness) of sustainable business models and the efficiency of their production.

Finding: Yes; the SSBMO appears to some degree to have these attributes.

That each of the detailed aspects of the research objective Rigor (RO0), Reliability (RO1a), Consistency (RO1b), Effectiveness (RO1c) and Efficiency (RO2) have significant confirmatory feedback supports this conclusion (Table 8-14).

In turn this lends support that the research question may be answered in the affirmative:

RQ: Is it possible to design a model of a business that can be usefully employed to describe a firm's environmentally, socially and economically sustainable business design?

Finding: Yes; the SSBMO is an example of such an artefact.

Finally these results must be examined in light of the potential weaknesses discussed in 8.1 (poor derivation of the design principles from the literature, or poor design of the artefacts – i.e. failure to adhere to the design principles or failure in the artefacts capture, coding and expression of the artefacts).

Again, the results suggest that while there is clearly room for improvement in research rigor and artefact utility, and while the designed limitations (2.6) clearly impact artefact utility, there is little or no evidence to suggest that these weaknesses are manifest.

8.10 Comparing Results to Working Hypothesis (E4)

This section returns to the Working Hypothesis (WH1-4, 2.4) in light of these results and conclusions.

Evidence to confirm or disconfirm the Working Hypothesis was first reviewed light of the literature reviewed during the preparation activity stream (throughout Chapter 3, 4.8, and Table 4-22).

Table 8-15 updates these finding by including the results of the evaluation activity stream presented this chapter.

Working Hypothesis	Overall Comments in Light of Literature Review & Evaluation
WH1. A model of business that can be used to describe designs of sustainable business can be built from existing knowledge of business models and sustainability.	**Confirmed**: The quantity and quality of the literature found and the confirmatory feedback from the evaluation activities suggests this hypothesis is true.
WH2. Current conceptions of business models are largely inadequate at conceptualizing sustainability.	**Confirmed**: The differences identified between the profit-first, ecological modernist and strongly sustainable conceptions of business models suggests that the former two have difficulty conceptualizing strong sustainability. Further feedback from the evaluation activities lends further weight to this assertion.
WH3. A model of sustainable business is perceived by managers as having validity and value. The model delivers value by allowing managers to understand gaps in their organization's approaches to increasing sustainability (these gaps vary between organizations, and by groups of organizations – such as firms in a particular sector; the are many reasons for these gaps)	**Partially Confirmed**: The existence of a significant stream of research and practice, as well as evidence gathered during the evaluation activities, suggests managers believe, generically, business models can be valid and have value. However, the formats and visualizations used to instantiate the SSBMO during the evaluation activities were unable to help managers identify gaps and opportunities for improvement, although they saw the artefacts as being conceptually capable of providing this function.

Working Hypothesis	Overall Comments in Light of Literature Review & Evaluation
WH4. A good starting point for helping managers increasing the sustainability of their organizations is to highlight gaps between current business design and potential future business design(s) and then identify reasons for those gaps.	**Partially Confirmed**: The literature and the evidence gathered during the evaluation activities suggests that a generic benefit of business models is that they can help managers understand gaps between current and future desired business designs and the reasons for those gaps. However, the formats and visualizations used to instantiate the SSBMO during the evaluation activities were unable to help managers identify gaps and opportunities for improvement, although they saw the artefacts as being conceptually capable of providing.

Table 8-15: Support for Working Hypothesis in Light of Literature Reviews & Evaluation Activities

Finally, the assertion that the Research Question may be answered in the affirmative, that the Research Objective has been met and that the Working Hypothesis #1 is confirmed, builds on the reflection in 7.2.1.3 and 7.5.3: That perhaps the SSBMC (and future further simplifications to close artefact utility gap GU9), in adopting design choices that at least partially avoid the undeniable underlying complexity of the 'real-world'.

Perhaps these simplifications may enable a strongly sustainable business model designer to change focus, ignoring now irrelevant complications that appeared in the BMO, and hence the net cognitive load in using the SSBMO and the SSBMC it powers remains unchanged compared to the BMO and the BMC it powers?

8.11 Result of Use of Research Design (E4)

The above sections 8.4-8.8 reported on the results of executing evaluation activity groups E1, E2, E3 and E4 as described in Chapter 6. This led to the identification of a number of gaps in research rigor and artefact utility.

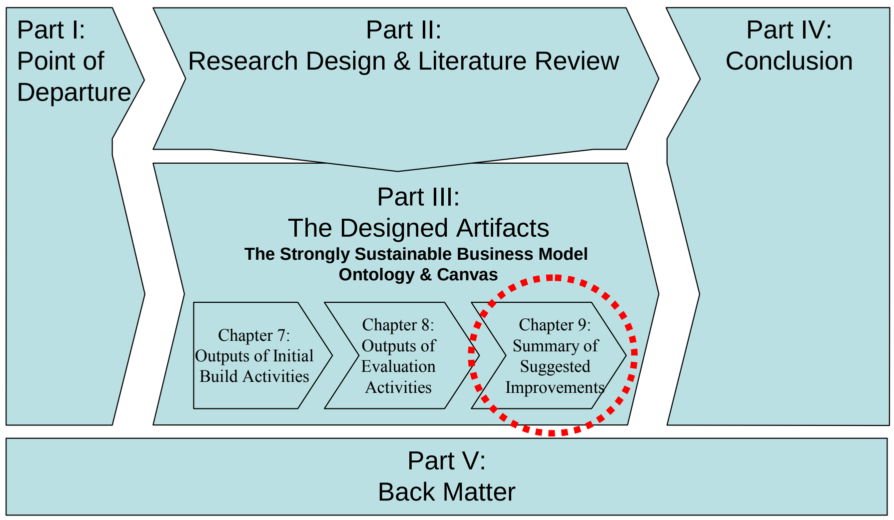
Reflecting explicitly on the execution of evaluation activity group E4, the feedback synthesis and analysis, one additional gap in research rigour is apparent. Evaluation activity group E4 identified the gaps, and fed them back to either the final iteration of build activity group D3 (after E1 and E2a), leading to SSBMO v1.031, or to the final build activity group D4 (after E2b and E3).

This gap reflects the fact that this feedback process was not a clean as the description above, and Figures 6-5 and II-3 may appear to indicate:

GR11: The level of control over the timing and sequence of the identification of gaps during the evaluation activity stream and the feedback of these gaps to the later build activity groups was not as tight as intended by the research design.

Chapter Nine: Summary of Suggested Improvements

*The scientist is a practical man and his are practical aims. He does not seek the **ultimate** but the **proximate**. He does not speak of the last analysis but rather of the next approximation — Gilbert Newton Lewis*



This chapter describes the output from the final build activity group (D4): preparation for the forth iteration of build. The steps set-out at the start of Part II, as embedded in the build detailed research design (Chapter 5) are used one last time. The gaps identified from the final evaluation activity group (E4), are searched (A) and reflected upon (B). This results in the identification of candidate changes to: the research design, to improve its rigour, and the artefacts, to improve their utility. A discussion is presented of how, if these changes to the research design and artefacts were applied, improvements in rigor and utility may result (C).

9.1 Introduction

As per the overall research design (Figure II-3), the final step of the research process (other than the communication of the research outputs and results), is the use of the gaps in research rigour and artefact utility identified in Chapter 8, to prepare for a fourth iteration of the build activity group (D4).

This preparation work considers each of the gaps in turn and suggests candidate improvements to the coding and capture of the SSBMO and the visual design tool it powers, the SSBMC. These candidate improvements, once used to change and evaluate revised SSBMO and SSBMC artefacts might further enhance their utility.

The execution of a subsequent iteration of the build activity stream (and the evaluation of the results of the revised artefacts) is out of the scope of this research.

9.1.1 Chapter Structure

This chapter is structured as follows:

- Section 9.2 determines candidate changes (CR1-8) to the research design to improve research rigor based on a reflection of the gaps in research rigor identified in Chapter 8 (GR1-11).
- Section 9.3 determines candidate changes (CU1-5) to the artefacts which might improve artefact utility based on a reflection of the gaps in artefact utility identified in Chapter 8 (GU1-11).
- Section 9.4 identifies limitations in research rigor and artefact utility claims based on a reflection undertaken by the researcher.

Together these topics help to identify limitations to the contributions of this research and support the identification of further avenues of research, which are described in Chapters 10 and 11 respectively.

9.2 Determine Candidate Changes (CR1..7) Based on Reflection on Gaps in Rigor of Research Design (GR1-11)

This section determines candidate changes (CR1-8) to the research design to improve research rigor based on a reflection of the gaps in desired research rigor (RO0) identified in Chapter 8 (GR1-11) and the difficulties and risks identified prior to commencing the detailed design of this research (R1-4, 3.6.10).

If used in subsequent iterations of this research, it is asserted that these improvements may further enhance the achievement of the overall research objective (RO), and specifically RO0:

> **RO0**: The research design will be of the highest quality possible: minimizing bias by maximizing rigour, hence maximizing the legitimacy of the research output.

For each of the 11 identified gaps in research rigour (GR1-11):

- The description of the gap is repeated (from Chapter 8).
- A candidate change to the research design is proposed based on a reflection on the gap and possible research designs that could close the gap (CR1-8).

In some cases multiple gaps may be resolved with a single candidate change.

9.2.1 Gaps in Research Rigor Closed During Subsequent Evaluation Activities

Two gaps in research rigour identified in evaluation activity group E1 and very early in E2b. These gaps were closed within the relevant subsequent evaluation activities as follows:

GR6: Problems with the definition of #7 on scale of Profit-First to Strongly Sustainable used in items E2b-Q-DG8 and E3-Q-DG-7a..d was highlighted in the first interview conducted during evaluation activity group E2b. Hence the definition of this item was changed from “balance achievement of environmental, social and economic goals” to “integrating achievement…” for all evaluation activities E2b and E3.

GR7: A clarification of the definition of Elegance (M10), was highlighted in the first interview conducted during evaluation activity group E2b. Hence the definition of this metric was split into two: “technical” or “intellectual” elegance (M10a) and “aesthetic appeal” (M10b) for all evaluation activities E2b and E3.

9.2.2 Expand World-Views of Comparator Knowledge Sources

GR1: Despite attempts, no feedback was gathered from persons with world-views that create any combination of low expectation of SSBMO utility, low desirability of that utility and low importance of that utility (6.4.6.2).

GR9: The lack of the 3rd profit-first world-view case study reduced the ability to validate ontology Overall Design Principle #2 (ODP2) had been fully adhered to.

CR1: Find additional respondents who

- Believe there is limited connection to business success of modelling complete businesses (i.e. that expending effort preparing business models has no utility) with a range of world-views from profit-first to strongly sustainable.
- Strongly hold to profit-first world view of the purpose of the firm.

Subsequently engage these additional respondents in additional evaluation via existing Third-Party Experts and Case Study protocols. Note the difficulty of attracting people with these world-views, given that title and objective of this research is, to some extent, setting out to suggest that the world-view of such people is scientifically invalid.

9.2.3 Increase Rigor of Evaluation of Definitions of Constructs and Model – CATWOE

GR2, GR5, GR10: For useful values of metrics M4 (Completeness), M5 (Satisfactory Level of Detail) and M8 (Internal Consistency) to be gathered and a report made on evaluation hypothesis E1a-EH1 and E1a-EH2, the CATWOE technique in a design science research requires the involvement of 3rd parties unrelated to the artefacts or the process of their creation.

CR2: Amend the research design to include focus groups to use the CATWOE technique to construct comparator knowledge concerning:

- The definitions of the constructs and model for the SSBMO (E1a)
- The instantiation of the SSBMO expressing The Timberland Company's Business Model (E1c)

- The instantiation of the SSBMO expressing each case firm's business model respectively (E3)

The members of the focus group should be additional respondents to those already consulted. The Soft Systems Methodology and focus group literature should be consulted on the best practice techniques to be used to maximize research rigor and hence legitimacy of the output of this evaluation activity.

9.2.4 Increase Rigor of Evaluation of Definitions of Constructs and Model – Additional Existing Sources of Comparator Knowledge

GR3: Undertake comparative analysis using additional knowledge sources based on the strongly sustainable world view, but derived independently of the strongly sustainable key theoretical frames.

CR3: Since the completion of the preparation activity stream the researcher has become aware of a number of other frameworks for the assessment of business strong sustainability in addition to the B Labs B Impact Assessment Survey used in evaluation activity group E1b. Further the B Impact Assessment Survey continues to evolve with a larger company version due to be released in early 2014.

Like the B Impact Assessment, these additional strong sustainability assessment frames were developed independently from the strongly sustainable key theoretical frames (K0, K0-SS, Chapter 3 and 4). However ,they are conceptually well aligned with them.

Additional comparator knowledge sources include:

- The PROmoting Business Excellence (PROBE) bench marking tool which was independently derived from the Framework for Strategic Sustainable Development (4.4.3.2 Sustainability, 4.6.4 and Figure 4-15)[25].
- "The Good Analyst Impact Measurement and Analysis in the Social-Purpose Universe" is a knowledge source based on the strongly sustainable world view, but

[25] http://probe-network.com/

created entirely independently of the strongly sustainable key theoretical frames (Hornsby, 2012).

- Network for Business Sustainable report on stakeholders, relationships and partnership (Turcotte, 1995; Turcotte & Pasquero, 2001). Although this report is largely ecological modernist in outlook, comparing it to the SSBMO conception of stakeholder ought to generate useful evaluative data.

9.2.5 Reduce Bias in Evaluation Activities

GR4: Seek methods that reduce the potential for bias and increase likelihood of gathering feedback concerning opportunities for improvement.

GR11: The level of control over the timing and sequence of the identification of gaps during the evaluation activity stream and the feedback of these gaps to the later build activity groups was not as tight as intended by the research design.

CR4: A range of mechanisms to further reduce bias in the evaluation activities are well known, but were not used due to the restrictions on researcher time and resources to engage other investigators. Adding additional investigators would enhance the performance of the chosen further triangulation mechanisms, possibly significantly.

For example:

- Addition investigators, trained in the comparator knowledge sources identified in E1 (K1, K2 and K3), could also be used to undertake these evaluation activities and the overall result of these evaluation activities synthesized from the researcher and these additional investigators.
- Additional investigators could have participated in all of the 3rd party evaluation activities (E2 and E3) and the overall result of these evaluation activities synthesized from the researcher and these additional investigators.

9.2.6 Reduce Avoidable Causes of Respondents Identifying Opportunities for Improvement

GR8: A minority of the opportunities for improvement identified by respondents were due to misunderstanding or misperception of various aspects of the SSBMO and example instantiations.

Understanding many of these misunderstandings and perceptions, such as choice of labels for entities, is useful and legitimate feedback. However, in many cases the feedback was more a reflection of the approach taking to the briefing of the respondents rather than a reflection of artefact utility.

CR5: The briefing presentation used in evaluation activity E2 could have been formally tested with additional respondents with a range of world-views prior being used as part of the evaluation protocols to gather comparator knowledge. This would have improved the quality of the feedback by reducing the possibility of respondents identifying opportunities for improvement based only on common misunderstandings or misperceptions.

9.2.7 Further Diversify Evaluation via an Additional Evaluation Technique

This candidate improvement to the research design did not originate directly from a reflection on the evaluation activities, but a more general reflection.

The BMC is widely used, as illustrated by the fact that the first case study participant (E3a) had previously attempted to use the BMC to describe their firm's business model. In this case the respondent has a strongly-sustainable world-view, and hence felt the need to change the BMC to capture the aspects of their business model considered important.

This independent activity by this case participant lends support to the original gap identified in the business model literature (2.1) from which the research question and objective are identified (RQ and RO).

CR6: An additional evaluation technique, the 'natural experiment', may be possible that could gather a new type of comparator knowledge[26].

Such an experiment might be conducted by recruiting participants, who like the first case study respondent, hold a strongly-sustainable world view, and had ***already*** attempted to use the BMC to describe or design a strongly sustainable business model. A range of techniques (interviews, focus groups, etc.) could be used to:

- Deeply understand the problems encountered using the BMC (if any) or any 'force fitting' of strongly sustainable concepts to the BMC constructs and model.
- Present the SSBMC as an alternative to the BMC to determine whether the respondents feel the SSBMC has more or less utility than their own use of the BMC.

A less 'natural' version of the experiment with a wider range of possible confirmatory and opportunities for improvement feedback would be to:

- Gather a number of business model designers with a range of world views.
- Present a case to them which requires them to design a strongly sustainable business model using the BMC and the SSBMC. The order of design tool use would be varied to avoid bias arising from sequence.

9.2.8 Further Diversify Evaluation via an Additional Triangulation Technique

This candidate improvement to the research design also did not originate directly from a reflection on the evaluation activities, but a more general reflection.

Following the preparation of the findings presented in Chapter 8 the researcher has begun to develop an appreciation for the deeper conceptual connections between the items that helped construct the comparator knowledge sources and the metrics.

CR7: A more formalized triangulation technique for cross-case and cross-evaluation activity group may improve research rigor.

[26] Thanks to Prof. David Johnston for making this suggestion.

This would require the deep knowledge of the conceptual connections to be further identified and codified. It is highly likely that the qualitative analysis software tool used to assist with evaluation activity E4 could be used in this regard, in conjunction with revisions to Figure 6-9, Figure 6-10 and Figure 6-11 (6.8).

9.2.9 More Formally Confirm Selected Metric Coverage

This candidate improvement to the research design also did not originate directly from a reflection on the evaluation activities, but a more general reflection.

It was noted during the development of the detailed evaluation research design that some improvements in metric coverage might be achieved by adopting the following candidate improvement in research rigour:

CR8: Cleven et. al. provide both "Evaluation Functions" and "Evaluation Perspectives" (typology of metrics) in their evaluation research design framework. They refer to these as "Knowledge Control Development Legitimization" and "Economic, Deployment, Engineering, Epistemology" respectively (Cleven, Gubler, & Huner, 2009).

Research rigor could be improved by first mapping the chosen metrics to these functions and perspectives and then subsequently using this mapping confirm that the chosen metrics fully cover all possible categories of utility confirmatory and opportunities for improvement feedback. If such a mapping was not possible, this could help identify additional metrics.

9.3 Determine Candidate Changes (CU1-5) Based on Reflection on Gaps in Utility of Artefacts (GU1-11)

This section determines candidate changes (CU1-5) to the artefacts which might improve artefact utility, based on a reflection of the gaps in desired artefact utility (RO1 & 2) identified in Chapter 8 (GU1-11).

If used in subsequent iterations of the designed artefacts research (outside the scope of this project), these improvements may further enhance the achievement of the overall research objective (RO), and specifically RO1 and RO2:

RO1: Increase the quality (reliability, consistency, effectiveness) of strongly sustainable business models

RO2: The efficiency of their production.

In some cases multiple gaps may be resolved with a single candidate change.

9.3.1 Gaps in Artefact Utility Closed During Subsequent Evaluation Activities

Five gaps in artefact utility identified in evaluation activity group E1 where closed in the final iteration of the SSBMO produced at the conclusion of build activity group D3 (v1.031) and described in Chapter 7:

GU1: Locality not conceptualized sufficiently (socio/geographic nor bio-physical). In version 1.022 of the SSBMO, the initial output of build activity group D3 (Figure 5-2), locality had not be appropriately incorporated into the SSBMO (DDP6).

GU2: Type of legal entity for firms in a business model not conceptualized, e.g. Benefit Corporation, co-op, not for profit, government, for-profit, partnership, etc.). In version 1.022 of the SSBMO, the initial output of build activity group D3 (Figure 5-2), the legal entity of firms had not be appropriately incorporated into the SSBMO (DDP3).

GU3: Stakeholder diversity not conceptualized, e.g, diversity of the ownership of the organizations in a business model. In version 1.022 of the SSBMO, the initial output of build activity group D3 (Figure 5-2), stakeholder diversity had not be appropriately incorporated into the SSBMO (DDP5 and 6).

GU4: The attributes and entity inter-relationships listed in Table 8-5 are not appropriately conceptualized. In version 1.022 of the SSBMO, the initial output of build activity group D3 (Figure 5-2), these attributes and relationships, based on a range of detailed design principles (DDP1-6), had not be appropriately incorporated into the SSBMO.

GU5: The conceptualizations of the entity inter-relationships listed in Table 8-7 are neither fully appropriate nor complete. In version 1.022 of the SSBMO, the initial output of build activity group D3 (Figure 5-2), these relationships, based on a range of detailed design principles (DDP1-6), had not be appropriately incorporated into the SSBMO.

9.3.2 Gaps in Artefact Utility Due to Missing Attributes and Entity Relationships

GU6: The Need and Criterion entities are missing an attribute to conceptualize the time horizon for a need.

CU1: Add the following attributes to the Need and Criterion entities:

- Earliest time horizon in which need must be met to create value, and avoid value destruction.
- Latest time horizon, after which not meeting a need will lead to value destruction.

Such an attribute would allow the modelling of, amongst other things, the length of time an actor wishes a firm to continue to exist, e.g.: forever, at least x year, less than y years, until an exit strategy can be executed (acquisition, merger, IPO, closure).

9.3.3 Gaps in Artefact Utility Due to Missing Attributes and Entity Relationships

GU7: Concepts of mission (goals), vision, and values (culture, ethics, rights, leadership and decision making style) are inherent in the constructs within the Measurement and other perspectives (7.4.5.1). However, the familiarity of respondents with this specific terminology suggests that their omission (or at least a lack of an explicit explanation of how they relate to constructs in the SSBMO), reduces utility. The experts expected these concepts to be included in what they understood by a business model; their omission was unexpected and hence set up a barrier to engaging with the tool.

While not identified as a designed limitation of this research (2.6), it note worthy that the BMO has the same limitation, as described in the first three rows of Table 4-11.

GU8: Find a better way to address the relationships between the constructs in summary (SM3) and overview (SM5a) visualizations.

There are two alternatives for dealing with these gaps. The first suggests, as per 7.4.5.1, that with appropriate understanding of the connections between the constructs in the SSBMO and the commonly understood elements of leadership frameworks (mission, vision, goals, etc.), this gap would disappear. In other words the gap may be avoided by appropriate education of business model designers.

The second alternative is a change to the design of the artefact:

CU2: Amend the constructs and relationships to include the commonly understood elements of leadership frameworks as entities in the SSBMO and include the relationship of these entities to the existing entities.

This could include, for example:

- Gathering all the existing attributes which record goals for each entity in the Measurement perspective, and collecting them into a Goal entity.
- Adding entities for mission, vision, values etc.

9.3.4 Gaps in Artefact Utility Due to Level of Detail

GU9: Find a better way to provide a more accessible introductory visualization.

CU3: A number of the respondents offered suggestions as to how this opportunity for improving artefact utility they identified could be undertaken:

- Provide a three dimensional (virtual reality) visual representation of the SSBMO (Respondent E2b-1).
- Provide a "Layered model", present the SSBMC summary canvas first (the 14 questions, SM5a) and then "slowly peal the onion" (Respondent E2b-5). This would enable "elevator pitch" v.s "more details" (as requested by both Respondent E2b-5 and E3a).
- Segment or layer the model: "Relate existing constructs to goals to develop subsets of the business model of a company which traced the elements needed to attain that goal

and the measurement of that goal attainment" (Respondent E2b-6) or present the four perspectives three time, once for each context (Respondent E2b-7).

9.3.5 Gaps in Artefact Utility Due to Choice of Entity Labels

GU10: Determine better labels for Decision, Capability and Value Configuration entities.

These entities are already merged with others in the SSBMC with more commonly understood names (Resource and Activity respectively). As a result, leaving these as more technical entities, only appearing in the SSBMO, means they will only be encountered by people engaging deeply with the SSBMO. This may minimize the impact of this gap.

CU4: One respondent offered suggestions as to labels for one entity which they felt would better resonate with business model designers

- Decision entity: Governance or Accountability (Respondent E2b-4).

However, respondent E2b-7 suggested there was very widespread confusion amongst his business architect colleagues about the terms Capability and Value Configuration and while he felt he understood the difference offered no alternative label which might increase recognition.

9.3.6 Gaps in Artefact Utility Due to Lack of Diagnostic Mode

GU11: Determine a mechanism to record information necessary to tell the story of why an organization is successful or not (i.e. the logic which connects instances of entities to success or failure, i.e. the why). This would include the ability to describe large vs. small gaps between each instance of each entity to either the designed level of importance, or actual performance, to achieving the organizations definition of success.

In fact this gap is not a gap with the SSBMO, nor the SSBMC per se; the BMO conceptually has this same gap (See 3rd row Table 4-11). Rather the gap is in the way in which the example instantiations of the SSBMO were conceived for The Timberland Company (K3-BM and the case firm's K6-BM).

Both the current and intended performance (goals / definition of success) may be captured using the attributes in each of the entities in the Measurement perspective. However, in the visualization of the instances of these entities these attribute values were not included (i.e. the post-it notes only included the name / description of each instance of each entity).

Hence, this gap might be more appropriately considered part of designed limitation L6 (2.6): the lack of a method for the effective use of the SSBMO and SSBMC; albeit a limitation that partially disconfirms working hypothesis 3 and 4 (WH3 and WH4, Table 8-15). Such a methodology could include a diagnostic mode. This is in contrast to the other gaps that require a candidate change to the artefacts to be made to close a utility gap.

Hence, as part of any methodology and guidelines for the effective and efficient use of the SSBMO and SSBMC, business model designers could be advised on a number of techniques to diagnose performance problems and identify opportunities for improvement (a diagnostic mode).

Suggestions for the expression of instances of the SSBMO could include:

- Colour coding the post-it notes: green when actual and desired performance was satisfactory, orange when somewhat unsatisfactory and red when totally unsatisfactory.
- Including symbols on each post-it note: e.g. + for acceptable level of performance against goals, - for unacceptable level of performance.

9.3.7 Increase Utility through Improved Ability to Model Business Networks

This candidate improvement to the artefact utility did not originate directly from a reflection on the evaluation activities, but a more general reflection.

The criticality of understanding how the behaviour of the networks of businesses involved in a business model relates to the possible emergence of strongly sustainable outcomes is consistently reported in the literature (Chapter 4), and embedded in the working definition of a strongly sustainable firm (3.5.3.4 A Definition of Organizational Strong Sustainability)[27].

However, while not highlighted by the respondents, it is clear that while the SSBMO is quite capable of describing such networks due to the nature of an entity relationship model, the visual design tool, the SSBMC, lacks this capability. In v1.031 of the SSBMC (SM5) this capability is weak; the focal firm of the business model designer is front and centre with limited visual triggers (or space) to describe the business models of other firms in the relevant business networks.

CU5: A non-burdensome mechanism (or process in an accompanying methodology for the effective and efficient use of the SSBMO) is required to trigger a business model designer to consider and record or design the business network of which the focal firm is a part.

9.4 Limitations to Claims

This section identifies overall limitations in research rigor and artefact utility claims based on a reflection undertaken by the researcher.

One of the objectives of the evaluation activities is to identify limitations to the applicability and use of the designed artefacts. From a reflection undertaken by the researcher, limitations include:

- As expected, the chosen designed limitations (2.6) impact on artefact utility; this was evident by the number of opportunities for improvement related to these limitations, particularly the impact of the lack of a process for the efficient and effective use of the artefacts.
- Design science and systems methodologies generally suggest or imply the need for an action research (or better participative action research) approach by definition. i.e. without an action approach the researcher may not be able to call their work best practice in these fields, hence confidence in the results goes down.

[27] This definition, by design, makes it impossible for a single organization to declare that it is sustainable.

In this research, while others were involved in evaluation, the build activities were largely carried out by the researcher in isolation (following Osterwalder and Al Debei's lead).

- The entity relationship modelling paradigm is largely unable to model dynamic processes (functions), its focus being 'static' structure (i.e. layers of socially constructed information). Since human organizations, by the nature of their social construction are inherently dynamic, the limitation of the modelling paradigm restricts the ability of the SSBMO to model the dynamic aspects of organizations (Limitation L1).

  However, recently an opportunity to more deeply explore the Model of a Sustainable Organization (MoSO, Figure 4-19) with its authors, has highlighted that this model has the opposite limitation. Its paradigm is fundamentally about process, but as a result is restricted in its ability to model the structural constructs applicable to organizational strong sustainability.

  Discussions with the authors of MoSO suggest that the SSBMO and MoSO are highly complementary models: together they might be able to completely capture the function, structure, process and context for a strongly sustainable business and its design (3.5.4.3).

- Although an iterative approach to the literature review activities was undertaken during preparation (first undertaking a traditional review during P1-P7, and then undertaking a systematic review during P4 and P6), it is possible additional rigor in these reviews might have uncovered additional theoretical and / or practically relevant literature. Topics which it is felt were perhaps insufficiently explored include:

  – Pre-Herbert Simon antecedents of design research (e.g. Wallis, Nunamaker, Markus).

- The literature on business, organizational and individual innovation (this was the field in which exemplar ontology researchers El-Debei and Bullinger are situated). This could be important, since one of the claimed values of business modelling is its ability to enhance creativity, hence innovation and organizational efficiency, effectiveness and success.
- Formally exploring the organizational literature related to non-commercial entities. This research is formally limited to profit-making entities. However, given that the SSBMO can model any group of stakeholders and the needs that they believe their involvement in any organization can realize, suggests the strong potential for the SSBMO to be applicable to any type of human organization. This potential is further enhanced by the ability of the SSBMO to describe success in any terms the business model design considers important, not just monetary profit.

- Current lack of formal theories that integrate the research methods and designed artefacts in the Science of Design and the Systems Sciences fields.
- Our current knowledge of the antecedents of strongly sustainable outcomes in firms and networks of human organizations. Unfortunately, as with all human endeavours, we do not know what we do not know.

Part III: Closing

Nearing the End

This part has described in:

- Chapter 6, the artefacts created by this research by following the preparation and build detailed research design (Chapter 5), by adhering to the design principles, both derived from the review of the literature documented in Chapter 4.
- Chapter 8, the results of the evaluation of the utility of those artefacts through the creation of range of comparator knowledge sources, not used to create the artefacts, by following the evaluation research design documented in Chapter 6.
- Chapter 9, candidate changes that could be made to the research designs and the artefacts that could improve their utility.

Part IV: Conclusion

Tomorrows Child

i.
Without a name; an unseen face
and knowing not your time nor place
Tomorrow's Child, though yet unborn,
I met you first last Tuesday morn.

ii.
A wise friend introduced us two,
and through his sobering point of view
I saw a day that you would see;
a day for you, but not for me.

iii.
Knowing you has changed my thinking,
for I never had an inkling
That perhaps the things I do
might someday, somehow, threaten you.

iv.
Tomorrow's Child, my daughter-son
I'm afraid I've just begun
To think of you and of your good,
Though always having known I should.

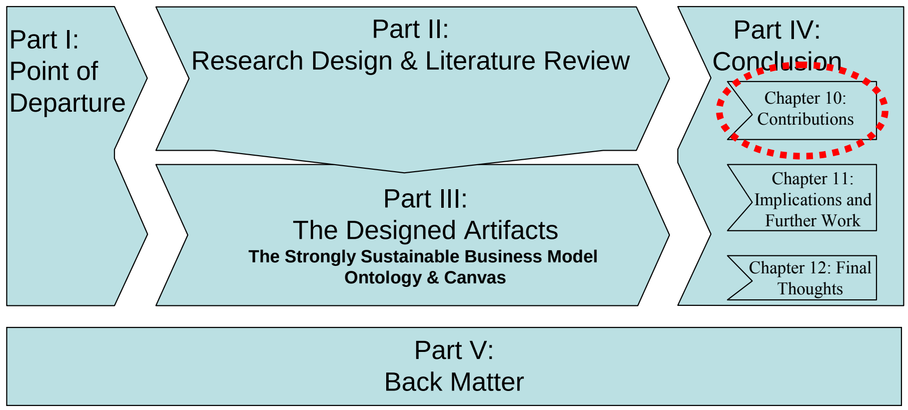
v.
Begin I will to weigh the cost
of what I squander; what is lost
If ever I forget that you
will someday come to live here too.

(Thomas, 1996)

This part describes the contributions (Chapter 10), implications and further work arising from this research (Chapter 11) as well as final thoughts on this research (Chapter 12). These topics are structured following the recommendations of leading design science researcher Hevner, as discussed in the design of the communication activity stream (II-3).

Chapter Ten: Contributions

All truth passes through three stages. First, it is ridiculed. Second, it is violently opposed. Third, it is accepted as being self-evident — Arnold Schopenhauer



Previous chapters presented what has been learned from the literature of organizational strong sustainability (Chapters 2-4), from the literature on rigorous systemic design science research design (Chapters 3-6) and from the design and evaluation of the artefacts that were proposed to meet the research objectives and respond to the research question (Chapters 7-9). This chapter explicitly identifies and substantiates which parts of this learning are significant findings, novelties and contributions to the "knowledge base" (Figure 3-19).

10.1 Introduction

This research has twelve outputs, four from each of the three design science activity streams (Prepare, Build and Evaluate): Constructs, Models, Instantiations and Methods (Table 3-13).

Hence, as shown in Figure 3-19, this chapter starts to close the loops from the research activities to the knowledge base by communicating which elements of these outputs are significant findings, novelties or contributions and thus "additions to the knowledge base (C2)" (Figure 3-19).

If others have offered these contributions earlier, but that I have failed to find them I offer my humble apologies and welcome the correction.

10.1.1 Chapter Structure

This chapter reports on the contributions of this research by grouping the twelve research outputs, structured as follows:

- The first sections describe the broad contextual contributions:
  - Section 10.2 describes novel conceptions of the problem and solution space, and their framing to provide an intellectual platform for the other methodological, conceptual and practical contributions.
  - Section 10.3 describes weaknesses and gaps in existing knowledge identified as a result of:
    - Novel analysis and / or synthesis of the literature
    - The results of the building and evaluation of the artefacts.
- Section 10.4 describes the significant methodological findings, novelties and contributions to the knowledge base from the design and execution of the systemic design science activity streams.
- The next sections describe significant findings, novelties and contributions arising from the constructs, models and instantiations from the design science activity streams:
  - Section 10.5 describes improved definitions of constructs and models offered by this research to the knowledge base.
  - Section 10.6 describes contributions embedded within the capture and coding of the constructs, models and instantiations of the artefacts that are novel to practice.
- Finally, section 10.7 summarizes all these contributions using the structure provided by Table 3-13, and offers a brief reflection on the significant findings, novelties and contributions to the knowledge base presented in this chapter.

10.2 Conceptual Contributions: Problem and Solution Space Framing

10.2.1 Introduction

This section describes novel conceptions of the problem and solution space, and their framing that provides a platform for the other methodological, conceptual and practical contributions.

10.2.2 Importance of World-View

The identification of the importance of the world-view of the business model designer within both the problem and solution space of organizational sustainability was not encountered in the literature (3.4.6.1).

Further the idea that the world-view influences business model designer's understanding of the bodies of knowledge embedded in an ontology and subsequently the creation of both their normative design goals and instantiations of an ontology was also not conceptualized in the literature (3.5.1.5 Achieving the Generic Benefits of Ontologies with the Sustainable Business Model Ontology).

The identification of the central place of world view in sustainable organizational design led directly to the identification of Overall ontology Design Principle #2 (ODP2): the empathetic approach to the ontology user's world-view and the pragmatic approach to avoid prescribing organizational sustainability solutions via the designed artefacts. In turn this contributed to the achievement of the Research Question: the construction of an artefact with the highest perceived utility by business model designers.

10.2.3 Necessary Inter-Disciplinary Stance

Based on the traditional literature review (Preparation activity group P3) it was identified that to be aligned with the latest formal, natural and social science of organizational strong sustainability required the researcher, in the terminology developed in Chapter 3, to take an ecological-micro-sociological and ecological-micro-economic inter-disciplinary stance.

Without taking such an ecological stance, any micro-sociological or micro-economic researcher is unlikely to be able to accept and use the latest relevant ecological (i.e. systems oriented) formal and natural scientific knowledge of organizational strong sustainability (3.5.3). Hence it is highly likely their theorizing and artefact development would be incompatible with the latest formal, natural and macro-sociological science (3.5.3.1).

This research is one of the few pieces of research encountered in the field of organization and management to take such a fundamentally inter- and perhaps a trans- disciplinary stance as its starting point (compare neo-classical profit-first conceptions described in 4.5 with ecological strongly sustainable concepts described 4.6). This despite considerable neo-classical normal science barriers to taking such a position.

As a result, this research could be said to be not only contributing to established fields, but opening a new applied field of research: strongly sustainable business models and modelling. This idea was first put forward in a recent blog post for the Ontario College of Art and Design University's Strategic Innovation Lab Strongly Sustainable Business Model Group[1] (Upward, 2012a). Proposing such a new field of research to be legitimate is asserted to be a contribution[2].

In addition, this research makes a contribution in the currently nascent inter-disciplinary fields of ecological micro-sociology (organization and management) and ecological micro-economics, in its attempt to remain compatible with the latest available systems age formal science, and ecological- natural, macro-sociological and macro-economic science (Overall ontology Design Principle #1, ODP1, 3.2.3.3).

10.2.4 Possible Scope of Solution

From the literature that enables and justifies the inter-disciplinary stance taken, it appears that the availability of a relatively complete understanding of organizations' context is recent, perhaps only appearing in the past 10 to 20 years (Chapter 3).

[1] http://www.SSBMG.com

[2] See Chapter 11 for a proposed research agenda for this field of research, and section 11.3 for a discussion of how this research agenda aligns with the research agenda of related fields and disciplines. It is asserted that in proposing a research agenda for this new field of research is also a contribution.

Recognizing this relative recent but sufficiently complete state of the knowledge base enabled this research to make a bold assumption: it is now possible to attempt to completely conceptualize both the problem and solution space of organizational strong sustainability, i.e. it is possible to attempt to respond to the Research Question.

The systematic literature review (Preparation activity group P4) made a contribution by offering the first rigorous attempt at synthesis of all the formal, natural and social science literature which supports this assumption (Chapter 4).

As demonstrated by the highly positive reception to this work encountered during the evaluation activities (Chapter 8), the assumption and the synthesis that supports it appear to be a major practical and likely a significant theoretical contribution of this research.

That no other exemplar models produced in an academic research context that made this assumption were found tends to support the novelty of this key framing assumption (4.6.5.9)[3].

10.2.5 Possibility to Define Organizational Strong Sustainability

At the same time, the recognition of the relative level of completeness of the knowledge of organizational strong sustainability enabled this research's novel definition of organizational (ecological-micro-economic and ecological-micro-social) strong sustainability (3.5.3.4 A Definition of Organizational Strong Sustainability).

That the definition of organizational strong sustainability is simultaneously normative and paradoxical both enable it to remain highly compatible with the latest formal, natural and social science, and move well beyond currently common neo-classical understandings of organizational and societal sustainability, currently in use in both academia (4.5) and practice.

[3] An alternative explanation is that this research is not epistemologically, ontologically or axiologically valid.

The definition offered is normative since it talks of possibilities, which must necessarily be based on the subjective world-view of the reader. It is paradoxical because

1. It is not possible for any single organization to declare it is strongly sustainable in isolation of other organizations and individuals in its business network, and
2. The definition is based only on elements that will be forever mutable over time (world-views, state of nature, 3.4.6) and hence its achievement may only be determined with hind-sight.

10.2.6 Recognizing and Overcoming the Limitations of Descriptive and Design Science Modes of Knowledge Production for Organizational Strong Sustainability

This research project did not start with a particular epistemological bias (3.2). Instead an exploration for an appropriate epistemic mode, based on the conceptualization of the problem and solution space (3.3), was undertaken.

Once the inter-disciplinary knowledge base of organizational strong sustainability had been synthesized into the working definition of organizational strong sustainability (3.5.3.4) it became apparent that there are no organizations currently in existence that meet this definition in practice.

Hence in the search for an epistemological approach that recognized both the implications of organizational strong sustainability and the lack of extant phenomena led to the identification that the descriptive science epistemology:

1. Can only be effective when real world phenomena exist from which theory can be developed and justified.
2. Does not easily incorporate the importance of the world-view and hence normative stance required by the working definition of organizational strong sustainability.

Further, the search for a valid epistemological approach for organizational strong sustainability knowledge production recognized the limitations of existing conceptions of design science epistemologies when applied to organizational strong sustainability: In this problem domain there is nothing inherent in design science process nor results that recognizes that the central phenomena, strong sustainability, is emergent, and hence may only be well understood through a systems thinking lens (3.5.2).

This research formally and explicitly recognized, in relation to the chosen research question and objective, the above limitations of descriptive science (3.3) and design science (3.5.2). An attempt to overcome these limitations was then developed: a novel, formal and explicit process that identified and synthesized systems thinking, ontology engineering and design science epistemologies into a single integrated research design (Chapters 3-6).

Hence contributions of this research are the explicit:

- Process used to formally identify the limitations, ***and*** the use of that process to identify the limitations both the most common mode (descriptive science) and a emergent mode (design science) of knowledge production for organizational strong sustainability.

- Process used to identify synthesize and justify, ***and*** the use of that process: a novel systemic design science epistemology fully capable of responding to the research question and objective in the context of an ecological- micro-social and micro-economic understanding of organizational strong sustainability.

10.2.7 Creating Possibility for Organizations More Likely to Enable Emergence of Strongly Sustainable Outcomes

The above framing ultimate led to the artefacts described in Chapter 7 to be created: the SSBMO and SSBMC. In turn, based on the results of the evaluation activities (Chapter 8 and 9), it appears, perhaps for the first time, that by using the artefacts designed by this research, systematic attempts may by made to design and operationalized business models whose results include emergent outcomes that more closely approximate to the natural, macro-social and macro-economic science of strong sustainability.

Since the epistemology approach taken is partially legitimated by its formal and explicit use of relevant descriptive science truths (the key theoretical frames, K0, K0-PF, K0-SS, Chapters 3 and 4), the quantity, quality and timely creation of useful and utilizable organizational strong sustainability knowledge is thus increased.

Hence, the artefacts created by this research may directly or indirectly help to bring into being new phenomena that ***can*** be effectively studied by descriptive science: organizations whose operations may result in the emergence of increasingly strongly sustainable outcomes.

This in turn could lead to improved micro-social and micro-economic theories of organizational strong sustainability compatible with the current formal, natural and ecological- macro-social and macro-economic science.

In contributing to the increased velocity of the mutually reinforcing knowledge production and phenomena creation cycle (Figure 3-5), this research is making a small contribution to the resolution of the Global Problématique (1.2.1), and hence to "the possibility that human and other life will flourish on this planet forever" (3.4.6.1).

To increase the possibility of this contribution becoming manifest, the proposed future research agenda (Chapter 11) suggests avenues of descriptive and design science research, as well as praxis, that if acted upon, might in a larger way contribute to "the possibility that human and other life might flourish on this planet forever".

10.3 Conceptual Contributions: Identification of Weaknesses and Gaps in Existing Knowledge

This section describes weaknesses and gaps in existing knowledge identified as a result of novel analysis and / or synthesis of the literature and / or in light of the results of the building and evaluation of the artefacts.

This research contributes by identifying and justifying the following weaknesses and gaps in the prior existing knowledge base:

1. Existing conceptions of business models are implicitly based on the idea that the over-riding and singular purpose of the designer of a business, based on that designer's world-view, is to make monetary profit (2.1, Chapters 3 and 4).

2. Lack of an integrated, systematic analysis and synthesis of the formal, natural and macro-social and macro-economic scientific literature relevant to the definition of sustainable organizations, their business models, along with compatible definitions of value, value creation, value destruction, and business model ontology design principles (Chapters 3 and 4).

3. Lack of a theory of the conditions required for the emergence of strongly sustainable organizations (Chapter 4), the associated business design principles for businesses wishing to meet these conditions and operational business measures and threshold values that measure their achievement (Chapter 7). Associated with this is the lack of a taxonomy for patterns of strongly sustainable business model designs (1.3.2) and the lack of a catalogue of patterns of strongly sustainable business model designs, described using such a taxonomy (1.3.2).

4. Lack of any comprehensive, peer reviewed critique of Osterwalder's Business Model Ontology, from a profit-first, or from a strongly sustainable world-view (Table 7-2 and discussion in most sections of Chapter 7).

5. Lack of a research method that applies an integrated synthesis of the literature (such as item #2, above) to create phenomena whose further study could lead to improved truths about organizational strong sustainability (Chapter 3).

6. Lack of recognition of the weaknesses of descriptive and design science epistemologies when applied to knowledge production related to organizational strong sustainability (Chapter 3).

    a. Lack of empirically validated research designs, methods, techniques and best practice advice to rigorously design and undertake the:

    b. Overall design and communication of design science or systemic design science research (II-2, II-3).

    c. Preparation activity stream of any design science or systemic design science research (4.2.1, 4.2.2.1), including specifically how to best summarize the results of literature reviews for their subsequent rigorous use in the subsequent build activity stream.

d. Build activity stream of any design science or systemic design science research (5.2, 5.3.1), including specifically how to rigorously use the results preparation activities to maximize the possibility for artefact utility.

e. Evaluation activity stream of any design science or systemic design science research (6.2, 6.3.1).

Along with the above description of the gaps and weaknesses, the traditional and systematic literature reviews that led to their identification (Chapter 3-6), are also contributions.

The number and nature of these gaps and weaknesses supports the assertion that:

1. In closing the gaps and overcoming the identified weaknesses there are opportunities for significant contributions to theory, practice and epistemological rigour, not to mention humanities ability to flourish into the future.

2. That research and practice concerning strongly sustainable business models and modelling is possibly a new field of practice (10.2.3)

These gaps and weaknesses are summarized in the articulation of the Research Question (RQ, RQa and RQb) and the Research Objective (RO, RO0, 1 & 2), creating exciting possibilities for organizational strong sustainability researchers and lending validity to the overall research design for this research.

The number and nature of these gaps and weaknesses also supports the assertion that this research is making a number of contributions though its attempt to formally, systematically, and simultaneously close so many of these gaps and overcome so many of these weaknesses during this single research project. Specifically, these gaps and weaknesses were rigorously identified and tackled in the processes used to create the overall design (II-2, Chapters 3) and the detailed research designs (i.e. methodological literature reviews which commence each of Chapters 4-6), in the resultant research designs (created and described in the latter parts of

Chapters 4-6) and finally in the execution of the research designs and in the evaluation of the created artefacts (Chapter 7-9).

10.4 Methodological Contributions: Research Design & Execution

10.4.1 Introduction

This section describes the significant methodological findings, novelties and contributions to the epistemological knowledge base from all three of the design science activity streams. Hence, this section summarizes the attempts made to close the methodological gaps identified in 10.3 within the relevant key theoretical frames (Chapter 3, 10.2).

A summary of the methodological contributions is presented using the analogy of the Norwegian fairy tail “Three Billy Goats Gruff”[4]: three Billy Goats wishing to cross a bridge to what they believe to be greener pastures, under which lives a troll who intends to block their passage. Details of the contributions are then described.

In this analogy the land on the side of the bridge from which the goats start is descriptive science and the body of highly valuable theoretical knowledge that this has generated on strong sustainability and organizational designs that might create such outcomes. But this existing pasture is no long able to support the goats’ desire to flourish. On the other side of the bridge is the smaller body of knowledge of strongly sustainable organizational designs generated by systemic design science from the construction and evaluation of artefacts in the real-world. The bridge is the bi-directional process which links these two forms of research (Figure 3-5).

Thus the key methodological contribution may be understood as

- A better understanding the nature of the ‘greener pasture’: reviewing the literature which indicates the validity of the systemic design science methodological approach to organizational and organizational sustainability research (3.4).

[4] (Wikipedia Authors, 2013b)

- Understanding that all is not as perfect on the other side of the bridge as perhaps the goats perceive: The identification of a number of gaps in the literature related to how to ensure rigour (and hence ensure legitimacy) when applying the epistemology of design science to organizational sustainability research (3.5.2)
- A possible approach or management technique to increase the production of the already green pasture and revitalise the production of the exhausted pasture: A novel integration of systems thinking and design approaches that improves the rigour of organizational sustainability design science research outputs, and through the knowledge so produced, enhances the ability of descriptive science to contribute to the field (3.5.3-4).
- A proposal concerning the nature of the best bridge: A novel approach to the selection of the type artefact to be built (an ontology) by considering the nature of artefact utility which may be found useful by business model designers (3.4, Figure 3-5).
- A proposal concerning the best way to cross the bridge: A novel systemic design science approach to the construction and evaluation of the chosen artefacts (Chapters 3-6).

All this suggests there are opportunities for significant contributions to theory, practice and epistemological rigour, not to mention humanity's ability to flourish into the future, through the use of systemic design science to undertake organizational strong sustainability research. These perspectives bring exciting possibilities for organizational strong sustainability researchers and suggest the validity of the overall research design for this research.

The following sections explore each of these contributions.

10.4.2 Novel Rigorous Integration of Design Science, Ontology Engineering and Systems Thinking Epistemologies for Organizational Strong Sustainability Knowledge Production

A contribution of this research is the process used to integrate and the resulting novel integration of design science (3.4), ontology engineering (3.5.1), and system thinking epistemologies (3.5.2-3.5.3).

As described in Chapter 3, there are clear commonalities between Design Science and Ontology Engineering, and between Design Science and Soft Systems research. However, it is only recently that theory and epistemology in these three traditions has started to be integrated, the so called "Third Generation" Systems Thinking Design Science Method (Baskerville, Pries-Heje, & Venable, 2009; Broadbent, 2003; Pourdehnad, Wexler, & Wilson, 2011b).

However, no work was located that attempted, in the context of organizational strong sustainability knowledge production, to:

- Review and analyse the literature of all three of these three epistemological approaches
- Integrate Ontology Engineering with Soft Systems methods
- Integrate all three epistemologies.

Hence, the integration attempted here of all three epistemologies is a key methodological contribution of this research (Chapter 3-6).

This novel systemic design science approach, developed to meet the rigor research objective (RO0, 3.5 Challenges One and Two), is conceived in the context of research to develop a strongly sustainable business model artefact. However, as a further potential contribution, the literature review suggests the systemic design science approach is likely applicable to any artefact related to organizational strong sustainability. This is because the two aspects of "Challenge Two" (2-1 and 2-2) relate not to the nature of the artefact but to the nature of the problem and the overall epistemic approach (3.5.2.4).

While this research shows that the theoretical integration of systems thinking and design science epistemologies has started, exemplar research that operationalize these epistemologies in the organizational strong sustainability field were not found. Hence, another contribution of this research is in its successful operationalization of a "Third Generation" Systems Thinking Design Science method.

Next, given the integration of design science and systems thinking is nascent, there was lack of literature that provided specific advice on systemic approaches to design science sustainable organizational research design and operationalization. Hence another contribution of this research is in its identification of this lack of advice and experience (3.5.2.4) and its derivation, from best general academic research practice and the nature of the problem and solution space, of a rigorous iterative methodological approach and its subsequent execution, i.e.:

- Iteration 0: Identification of the Search [A], Reflect [B], Apply [C] steps (Figure II-2)
- Iteration 1: Identification of Research Conceptual Framework (3.2.3.1-2), Key Theoretical Frames (3.2.3.3) and overall Systemic Design Science approach (3.5.4)
- Iteration 2: Identification of the detailed research designs (Chapter 4-6)
- Iteration 3: Execution of the detailed research designs (Part III)

A further contribution is both the rigorous and systematic process of selection and the subsequent use of this process to select the ontology as the type of artefact with high utility to managers of firms seeking to improve organizational sustainability. As highlighted in "challenge one" (3.5.1), there are many potential artefact types that may have high utility in this problems space. Hence in this research a novel set of attributes of high utility was first derived from the literature (3.5.1.1-2) and then used to confirm that a business model ontology met those attributes (3.5.1.3-4, Table 3-7).

10.4.3 Improvements to (Systemic) Design Science Communication Activity Stream Research Design and Execution

As noted in 10.3, gap 7a., limited advice on the design of the communications activity stream of a design science research project was found.

Hence, the explicit, consistent and rigorous process of designing, the design (II-3) and the execution of the communications activity stream (resulting in this thesis) is asserted to be a contribution. Little literature advising the researcher on this aspect of design science research, and certainly no comparison of alternatives such as that undertaken in II-3, was found.

10.4.4 Improvements to (Systemic) Design Science Preparation Activity Stream Research Design and Execution

As noted in 10.3 (gap 7b), limited advice on the design of the preparation activity stream of a design science research project was found. Specifically, no advice was located as to how best (i.e. with reasonable traceability and repeatability) summarize or synthesize literature of the problem and solution spaces so that it may subsequently be assured that the truths the literature contains were adhered to in the artefact resulting from the build activity stream.

This research proposed a novel solution to this challenge through the:

1. Definition of design principles in the context of design science research producing an ontology (4.2.1.6) and in the specific context of the research question (4.2.4.4).
2. Setting goals for the creation of the design principles within the context of the specific research question (4.2.2.2 Design Goals for Creation of the Detailed Design Principles).
3. Design of a process for the creation of ontology overall and detailed design principles from a traditional and systemic literature review, all the while
    - Confirming adherence to the identified goals (4.2.2-4)
    - Minimizing the impact of the identified constraints and incorporating best practice methods and techniques (4.2.1.7).
4. Subsequent execution of this process to derive two Overall ontology Design Principles (ODP1, 3.2.3.3 and ODP2, 3.5.1.5 Achieving the Generic Benefits of Ontologies), six ontology Detailed Design Principles (DDP1-6, 4.3-4.6) and four Canvas Design Principles (CDP1-3) (4.7.4).

The rigorous creation of design principles from the literature prior to commencement of the build activity stream enables traceability and repeatability. The approach taken enables the researcher and / or third parties to validate both the correctness of the derivation of the design principles and that the artefacts subsequently constructed adhere to the truths in the literature (Chapter 4). This level of transparency and hence verifiability, is at a minimum highly unusual, and more likely a unique contribution of this research. It lends a possibly unprecedented degree of legitimacy to the utility of the artefacts and other knowledge output from this research.

Further, the explicit identification of the design principles is also asserted to be a unique contribution to the field of semi-formal domain ontology engineering, design science and systemic design science (3.5.1.5 Chosen Ontology Type). Certainly the identification and consistent use of these novel methodological approaches far exceeds the rigour of any of the exemplar PhD organizational ontologies (3.5.1.3 Exemplar Organizational Ontologies). That the design principles are derived from the literature using a transparent process with a documented audit trail lends a unique combination of weight and verifiability (Chapter 4).

10.4.5 Improvements to (Systemic) Design Science Build Activity Stream Research Design and Execution

As noted in 10.3 (gap 7c), no advice was located as to how best (i.e. with reasonable traceability and repeatability) rigorously use the results of preparation activities to maximize the possibility for artefact utility.

This research proposed a novel solution to this challenge through the:

1. Setting of goals for the creation of the artefacts (5.3.2) and the identification constraints on their achievement (5.3.2.4).
2. Explicitly identifying build principles for the process of creating the artefacts (BP1 & 2, 5.4.1), based on the goals.
3. Designing a process for the creation of the artefacts while confirming adherence to the build principles (5.4.2-9, 5.5-5.8), minimizing the impact of the identified constraints, and incorporating best practice methods and techniques (5.2.5).

4. Explicit and consistent use of a single modelling formalism to capture, code and visualize the artefacts (5.2.6, 5.4.3-5.4.8, Chapter 7, Supplementary Materials).

Together these novel approaches to the build activities are also asserted to be a unique contribution to the field of semi-formal domain ontology engineering, design science and systemic design science (3.5.1.5 Chosen Ontology Type). Certainly the identification and consistent use of these novel solutions exceeds the rigour of any of the exemplar PhD organizational ontologies (3.5.1.3 Exemplar Organizational Ontologies).

These novel approaches included provision for an unprecedented level of potential for 3rd party verification and validation. This is enabled by the rigorous, and hence transparent and traceable process by which:

- The summary visualizations (SM4) were produced from the detailed formal diagrammatic representations of the SSBMO (SM3) (5.4.5)
- The SSBMC visual design tool was derived from the SSBMO (5.4.6).

10.4.6 Improvements to (Systemic) Design Science Evaluation Activity Stream Research Design and Execution

As noted in 10.3 (gap 7d), limited advice was located as to how best (i.e. with reasonable traceability and repeatability) evaluate the utility of a design science artefact of any type.

This research proposed novel solutions to this challenge through the:

1. Comprehensive systematic review of the ontology engineering, soft systems methodology and design science evaluation literature to understand:
    - The purpose of evaluation (6.2.3)
    - The best practice processes for undertaking evaluation of designed artefacts (6.2.4)
    - The process for matching metrics to the nature of the utility of the designed artefact (6.2.6.2)

- The definitions of possible metrics used to evaluate artefact utility (6.2.6.3)
- The best practice techniques for capturing values of metrics of artefact utility (6.2.7).

2. Setting of goals for the design of the evaluation activity streams (6.3.2) and the identification of constraints on their achievement (6.3.3).
3. Explicit identification of a process for creating the evaluation activity stream research design (6.3.4).
4. Design of a process for the evaluation of the artefact's utility. This design explicitly confirmed adherence to the identified evaluation goals (6.4, 6.5-6.8), minimizing the impact of the identified constraints and incorporating best practice methods and techniques (6.2.7).
5. Explicit and consistent definition, selection and use of the metrics for evaluation (6.4.7, 6.4.8, Chapter 8), including:
    - Explicitly relating each metric to
        – The overall research goal and question (Table 6-22, Table 6-25)
        – To one or more comparator knowledge gathering activities, including individual semi-formal interview items (6.5-6.7)
    - Formally identifying knowledge, method and technique for deriving valid values of each metric:
        – The identification of comparator knowledge sources (K1-6) independent from the key theoretical frames used to create the ontology and canvas design principles (K0) (3.2.3.4, 6.4.6.4, 6.5-6.7).
        – The identification of applicable methods and techniques for the comparison of each type of comparator knowledge and the designed artefacts (6.4.8-6.4.9, 6.5-6.7).

- Formally identifying the design of the process to derive valid values for each metric and the subsequent identification of gaps in utility and rigour (including the explicit design for the use of a computerised qualitative analysis tool, 6.8).

Together these novel approaches are asserted to be a unique contribution to the fields of design science, systemic design science and semi-formal domain ontology engineering (3.5.1.5 Chosen Ontology Type), i.e. these contributions are believed not to be limited to the field of the research question and the chosen type of artefact.

Certainly the identification and consistent use of these novel solutions far exceeds the rigour of any of the exemplar PhD organizational ontologies (3.5.1.3 Exemplar Organizational Ontologies).

In particular, the use of an explicit process for creating the evaluation research design of any design science artefact is believed to be of particular value; nothing like this was identified in the literature.

Finally, in the rigorous application of the limited advice available (from Cleven, Table 6-19 and Leddington, Table 6-20) this research provides an exemplar for the validity and effectiveness of this advice for further methodological theorization.

10.5 Conceptual Contributions: Improved Definitions

10.5.1 Introduction

The next sections describe significant findings, novelties and contributions arising from the constructs, models and instantiations developed. This section describes improved definitions of constructs and models offered by this research to the conceptual and theoretical knowledge base. The next section describes contributions embedded within the capture and coding of the constructs, models and instantiations of the artefacts that are novel to practice.

These contributions are labelled “conceptual”, since they arose from the review of the literature, not from the creation of the artefact. They potentially have value to other strongly sustainable organizational theoretical and design researchers as well as to practitioners.

Further, subject to confirmation by appropriate descriptive science, many of these conceptual contributions may turn out to also be theoretical in nature, e.g. identifying necessary and sufficient definitions of strongly sustainable business and business models. A reflection concludes this section offering support for this assertion, based on an existing framework for identifying theoretical contributions. Descriptive science research that might offer further confirmation of these asserted theoretical contributions is proposed in Chapter 11.

Hence, this section summarizes the attempts made to close the definitional gaps identified in 10.3 within the key theoretical frames required to conceptualize the problem and solution spaces (Chapter 3, 10.2).

10.5.2 Definition of Organization Strong Sustainability

As noted in 10.3 (gap 2), no definition of organizational strong sustainability was found that was compatible with the literature describing the key theoretical frames.

Hence the working definition of organizational strong sustainability (3.5.3.4 A Definition of Organizational Strong Sustainability) offered in this thesis, synthesized from an inter-disciplinary understanding of the key theoretical frames, is asserted to be a contribution to the ecological- micro-social and micro-economic fields.

10.5.3 Definition of Strongly Sustainable Business Models

As noted in 10.3 (gap 2), no definition of a business model was found that was compatible with the working definition of organizational strong sustainability.

Hence the working definition of a business model (3.5.1.4 Definition of Business Models) offered in this thesis, synthesized from an inter-disciplinary understanding of the key theoretical frames, is asserted to be a contribution to the ecological- micro-social and micro-economic fields.

10.5.4 Definition of Value, Value Creation and Value Destruction

As noted in 10.3 (gap 2), the search of the literature did not identify a definition of value, nor a definition of the processes of value creation or destruction compatible with the satisfaction of Fundamental Human Needs (Table 4-8) mediated by individual world-views (10.2.2 and 10.3 gap 1).

Hence the working definition of value and the processes of value creation and value destruction (4.4.3.5) offered in this thesis synthesized from an inter-disciplinary understanding of the key theoretical frames, is asserted to be a contribution to the ecological- micro-social and micro-economic fields.

10.5.5 Definition of Strongly Sustainable Business Model Ontology Design Principles

As noted in 10.3 (gap 2), no design principles for an ontology that can describe business models compatible with the previous three definitions was found.

The methodological contributions of the process used to generate the design principles have been described above (10.4.4 and 10.4.5), but the content of these principles is also asserted to be a contribution.

Hence, the strongly sustainable Overall ontology Design Principles (ODP1 & 2, Chapter 3), the strongly sustainable Detailed ontology Design Principles (DDP1-6) and the Canvas Design Principles (CDP1-3) (Chapter 4), synthesized from an inter-disciplinary understanding of the key theoretical frames, are asserted to be a contribution to:

1. The ecological- micro-social and micro-economic fields.
2. The efficiency and effectiveness of the study, development and improvement of ontologies of strongly sustainable business models.

The definition of the ontology design principles in this thesis in effect 'open sources' the subsequent creation by other researchers of (possibly dramatically) differently captured, coded and visualized ontologies and canvases for strongly sustainable business models. In other words, any researcher who constructs an ontology that adheres to the ontology design principles can be assured their ontology is leveraging all the relevant descriptive science truths of the key theoretical frames (i.e. these 11 design principles, for the purpose of ontology design, summarize the whole of Chapters 3 and 4). For subsequent researchers wishing to build an alternative strongly sustainable business model ontology, this means they are not compelled to repeat or refine the full review and synthesis of the literature undertaken here.

In turn this enables an unprecedented degree, diversity and speed of subsequent improvements in utility of strongly sustainable business model ontologies and the canvases they power. Anyone can design such an ontology or canvas, if they adhere to the ontology design principles. Such artefacts could have significantly improved utility over the artefacts output from this research. This enhances and contributes to the speed of creation of strongly sustainable organizational phenomena and to the flourishing of human and other life.

At the same time, it is significantly easier to determine if the ontology design principles need revision in light of new or changed formal, natural or social scientific knowledge relevant to organizational strong sustainability. Compare the process to make such a determination, to the much greater work involved in integrating new knowledge into a traditional and systematic literature review that is not summarized by design principles. That the ontology design principles could themselves be subject to techniques of 'configuration management' creates the possibility that they may be incrementally or perhaps radically improved with the emergence of new relevant knowledge. In turn this allows all strongly sustainable business model ontology designers who are attempting to adhere to these principles to more easily revise their ontology artefacts to remain current with the latest research. This creates the possibility that practitioners using these ontologies to describe and design strongly sustainable businesses are more likely to be using the latest truths from descriptive science, a key question for this research (RQa).

10.5.6 Proto-Theory for the Conditions Required for the Emergence of Strongly Sustainable Organization

As noted in 10.3 (gap 3), no theory for the conditions required for the emergence of strongly sustainable organizations was found in any of the key theoretical frame literature.

However, unexpectedly[5], the inter-disciplinary analysis and synthesis of this literature (Chapter 3 and 4) enabled the discernment and proto-articulation of such a theory (4.7.2). It is suggested that this early articulation of this theory is likely to include the necessary, but not the sufficient conditions for strongly sustainable organizations.

This proto-theory is asserted to be a contribution of this research.

10.5.7 Proto-Strongly Sustainable Business Design Principles

As noted in 10.3 (gap 3), no principles for the design of organizations that create the conditions identified in the above theory were found in the literature.

However, unexpectedly, the inter-disciplinary analysis and synthesis of this literature (Chapters 3 and 4) enabled the discernment and proto-articulation of such a set of business design principles (7.7); if followed by an organization[6], it is believed these principles would lead to the creation of the conditions for the emergence of a strongly sustainable organization. It is suggested that this early articulation of these business design principles is likely to include the necessary, but not likely to include a description of the sufficient principles.

These design principles may be used during business model (re)design using long term backcasting (i.e. “doing the right things right”). This applicability to a long term planning technique, contrasts with the predominant planning mode of forecasting, that can only lead to incremental improvement (i.e. “doing less harm”).

Further, these principles may be used as the basis for the development of a “Gold Standard” for the strongly sustainable organization; i.e. a set of metrics and threshold values of those metrics that demonstrate adherence in practice of an organization to these principles (7.7.7). In other words the proto business design principles (pBDP1-5) state the behaviours required to be strongly sustainable; the metrics and accompanying threshold values, enable required behaviours to be identified in any extant organization.

[5] As per Table 3-13 no theoretical outputs of this research were envisaged.
[6] Based on our current and incomplete understand of this paradoxical state.

10.5.8 Reflection on Conceptual Contributions Theoretical Nature

Reflecting on the above conceptual contributions one can see a pattern of derivations and connections; with each contribution above building on those prior. Together these contributions might be termed a 'conceptual framework' for strongly sustainable business. Together these contributions enable work that could lead to the definition, design, and measurement of strongly sustainable organizations. Hence, as asserted above, this conceptual framework may be a contribution to theory.

While theory was not identified as a planned area of contribution of this research (Table 3-13), the wider framework for research in information technology from which this assessment was made (Table 3-5), clearly identifies the potential for design science information systems research to make theoretical contributions.

Recently operations management scholars Holweg and Pieter van Donk (2009, p.4)[7] provided criteria for determining whether or not such a conceptual contribution might be 'elevated' to a theoretical contribution.

It is clear that the description of the conceptual contributions in this research does not align well with those typically found in the neo-classical operations management literature. This lack of alignment is as a result of both its fundamentally inter-disciplinary underpinnings, and its assumption of the necessity of a systems or synthetic approach.

However, given that operations management was formally identified as one part of the key theoretical frames of this research (3.5.3.4 Additional Key Theoretical Frames), Table 10-1 presents an analysis of the conceptual framework developed in this research against Holweg and Pieter van Donk's criteria for what they termed a " 'Good' Conceptual Frameworks", i.e. the criteria for a theoretical contribution.

[7] Discussion and commentary on this framework may be found on the Journal of Operations Management website (Meredith, 2009)

Criteria for "'Good' Conceptual Frameworks"	Arguments of a Theoretical Contribution from this Research	Self-Assessment of Force of Argument (Strong, Weak, Unclear, None)
Selectivity	The rigorous process for, and the resultant justification of the definitions, ontology design principles, proto-theory and proto-business design principles all highlight their necessity and the necessity for each of their elements.	Strong
Parsimonious use of Variables	The identification of the problem and solution space as within the 'real-world', consisting of the bio-physical, containing the social, containing the economic, as described by the formal, natural and social sciences, makes parsimonious a relative term. Of necessity, and as described (7.2.1.3), understanding the highly complex socially constructed phenomena of human organizations within this context is also complex. It seems unlikely that such complexity could ever be described in terms that would meet the generally understood definition of parsimonious. In turn this suggests this is perhaps a weakness of these neo-classically based criteria, i.e. they generally ignore the type of context that this research takes as given.	Unclear
Specificity	The rigorous process for, and the resultant justification of the boundaries of each definition, the ontology design principles, the proto-theory and the proto-business design principles have a high degree of specificity. Further the artefacts were evaluated to test the utility of these boundaries within the context of the research objective.	Strong
Compre-hensiveness	The rigorous process for, and the resultant summarizing of the inter-disciplinary key-theoretical frames, leading to the definition, ontology design principles, proto-theory and proto-business design principles all have the intent of ensuring comprehensiveness. Further the artefacts were evaluated to test the utility of this comprehensiveness within the context of the research objective.	Strong
Novelty	The number, nature and breath of the contributions based on the gaps identified (i.e. contributions related to: understanding of the problem, concepts, methods and practice) suggest a significant amount of novelty. Further, adding to this assertion, other artefacts that attempt the same combination of utility (RO1-2) in rigorously responding (RO0) to a similar research question (RQ), were not found.	Strong
Meaning	This research was conceived as creating an artefact to help managers "understand an existing, real-life managerial problem"	Strong

Table 10-1: Analysis of the Theoretical Contribution from this Research

Based on my self assessment of the criteria presented from an operations management perspective, the conceptual framework developed by this research appears to strongly meet five of the six criteria, with the remaining one, being unclear.

Based on this analysis it is asserted that together the conceptual contributions of this research do start to constitute a theoretical contribution.

10.6 Practical Contributions: The Artefacts

10.6.1 Introduction

The previous section described improved definitions of constructs and models offered by this research to the knowledge base. This section describes contributions embedded within the capture and coding of the constructs, models and instantiations of the artefacts that are novel to practice.

These contributions are labelled "practical", since they are realized by the designed artefacts whose goal is practical use by business model designers (RQ and RO). However, they potentially have value to other strongly sustainable organizational theoretical and design researchers as well as to practitioners.

Further, subject to confirmation by appropriate descriptive science, many of these contributions may turn out to also be theoretical in nature, e.g. identifying valid constructs and their inter-relationships required for strongly sustainable business models. Descriptive science research that might offer such confirmations is proposed in Chapter 11.

10.6.2 Overall Contribution

The result of the evaluation activity stream (8.9-8.10) suggests that, subject to the stated limitations:

- The research question (RQ) can be answered in the affirmative; the SSBMO does have utility to managers wishing to describe a firm's environmentally, socially and economically sustainable business design.

- The research objectives (RO) have been met: the SSBMO can help increase the quality (reliability, consistency, effectiveness) of sustainable business models and the efficiency of their production.

Given no similar artefacts were identified, theoretically nor practically, suggests that, this overall result is a unique contribution to practice. This contribution has three elements:

1. The creation of a novel tool useful to practitioners who wish to attempt to describe strongly sustainable business models (SSBMC).
2. The inclusion in this tool of an integrated conception of a business, rigorously based on the literature, fully situated in its complete context: environment, social and economic.
3. The use of an ontology (SSBMO) as the theoretical basis of this tool to maximize: acceptance (ontologies are not prescriptive, 3.5.1.5 Achieving the Generic Benefits of Ontologies), use (ontologies enable communication via their use of a consensual vocabulary, 3.5.1.3 Definition of Ontologies), and thus single and double loop learning.

These choices maximize the potential for effective communication and problem solving ingenuity between all types of users: researchers, practitioners and researchers and practitioners. This increases the possibility that practitioners are better able to create strongly sustainable businesses as real-world phenomena, leading to resolutions of elements of the Global Problématique. In turn these strongly sustainable businesses, are phenomena from which descriptive science may theorize. Together this may lead to a speeding up of the creation of improved theories for the subsequent improvement of the SSBMO and the SSBMC it powers.

10.6.3 Strongly Sustainable Business Model Ontology

Within the constructs and model of the SSBMO (the entities and their inter-relationships) there are also a significant number of specific novel conceptualizations, derived from the literature of the key theoretical frames. These are contributions in their own right:

- The revision to the Balanced Scorecard perspectives in line with the strongly sustainable (as opposed to the ecological modernist) literature (7.2.1.5, 7.3.3). This includes conceptualizing the value to business model designers of the utility of these perspectives (7.3.3.1). This is an aspect of utility that Osterwalder, while he used the Balanced Scorecard, did not identify.
- The systems oriented conceptualization of a firm as an ideal-seeking multi-minded purposeful system, and hence the requirement that the definition of a firm must necessarily be multi-faceted, comprising, its context (containing wholes) and sub-systems (contained parts), and hence its boundary (DDP2, DDP3).
- The necessity, within this definition, of considering all the multiple-minds whose involvement leads to the social construction and on-going 'existence' of a firm: i.e. the stakeholder perspective (7.3.3.3). This includes the following novel constructs:
  - Human and non-human actors and their fundamental needs who may become legitimized or impactful stakeholders of firms in a business model (7.4.3.2-3).
  - That individual human actors may play multiple stakeholder roles in multiple organizations in a business model, and may have multiple criterion for doing so (7.4.3.4-5)
  - That all stakeholder relationships with firms are based on a combination of mutually agreed levels of natural, human, intellectual, social, manufactured or financial equity (subject to systemic power imbalances between firms and stakeholders) (7.4.3.6-7)
  - That the channels between firms and all stakeholders are for the purpose of realizing the mutually agreed levels of equity, not just for the conveyance of value to customer stakeholders (7.4.3.8-9)
- The necessity, within these definitions of actors, needs, stakeholders and criterion, of conceptualizing that the product, learning & development perspective (7.3.3.5) must

include the idea that firms unavoidably create ***and*** destroy value for their stakeholders (7.4.4).

- The necessity, within the chosen definition of the firm, of conceptualizing a firm's processes, the process perspective (7.3.3.6), as occurring within ***any*** combination the economic, social and bio-physical contexts; and that a firm's processes must necessarily include the following novel constructs:
  - Which stakeholders get to make which decisions about what value propositions the firm offers to its stakeholders; how and where those value propositions are created and delivered, and how firm success is defined and measured (7.4.5.2).
  - Partnerships, conceived as the formalized relationship between a firm and ***any*** of its stakeholders (7.4.5.3-4).
  - Resources, conceived as the bio-physical and in-tangible stocks to which a firm has preferred access at a point in time, and until such a time that those resources no longer have a social context (7.4.5.5-6).
  - Bio-physical stocks, conceived of as outside the boundary of any firm in a business model, and the ultimate source and sink for all matter required by a business model, including the physical bodies of all actors (7.4.5.7).
  - Activities, conceived as the processes that lead, as per the laws of conservation of energy and matter, to the creation (or destruction) of value through: an (ultimate) increase in entropy, flows of benefits from eco-systems services, and intangible resources. Together these result in the transformation bio-physical stocks to which the firm has preferred access (bio-physical stocks cannot be created or destroyed – only transformed by the activities of a firm) (7.4.5.8-9).
  - Eco-system service benefit flows, conceived as outside the boundary of any firm in a business model, and whose benefit flows are required for the successful undertaking of any tangible firm activity (i.e. nearly all of them) (7.4.5.10).

Together these definitions offer the first set of constructs asserted to be necessary (though perhaps not complete) to model "cradle-to-cradle" business, including the modelling of the complete separation of "biological nutrients" (and the associated environmental-social-economic metabolism) from "technological nutrients" (within a related but entirely materially isolated metabolism).

- The necessity, within the chosen definition of the firm, of conceptualizing the definition of firm success and measurement, the measurement perspective (7.3.3.7, 7.4.6.1), as requiring environmental (natural scientific), social and monetary units, and that this is best accomplished through the following novel constructs:
  - A neologism. "tri-profit", a fundamental reconceptualization of monetary profit, is required to achieve and measure strong sustainability (7.4.5.3) and that this:
    - Requires a flexible approach to its calculation based on the definition of value, its creation and destruction (7.4.5.2)
    - Requires a new calculus for management decision making, the "Tri-Profit Calculus" (7.4.6.3)
    - May require values of metrics of a firm's processes in non-monetary units to calculate (7.4.6.5).
  - That existing monetary unit based metrics (cost, revenue, asset, account) may be successfully conceptually overloaded to include conceptions of environmental and social metrics (7.4.6.1, Table 7-67, 7.4.6.6-8).

  Further, the conceptualization of:

  - Assets and the relationship between a firm's processes and the definition and measurement of firm success, closes weaknesses in previous profit-first conceptions of a business model (4.4.5.7)

– All types of stocks of assets, capital, equity and liability, enable such ideas as 'life-time value' of a customer or other stakeholder to be modelled, closing weaknesses in previous profit-first conceptions of a business model (7.4.5.8)

In addition, although less formally justified[8], in the identification of the attributes of the entities within the SSBMO, and their possible values, there are numerous conceptual and practical novelties, in general, and specifically in comparison to the BMO.

10.6.4 Strongly Sustainable Business Model Canvas

The SSBMC is not rigorously captured and coded (5.4.6). However it is a compatible visual simplification of the SSBMO. Hence, the SSBMC has, subject to the simplifications described (7.5), all the same contributions as the SSBMO. However, these contributions are in relation to earlier practitioner business model visual design tools (such as the BMC) rather than earlier academically defined business model typologies, taxonomies and ontologies (such as the BMO).

10.6.5 Instantiations of the Strongly Sustainable Business Model Ontology and Canvas

There appears to be some small contributions to practice of the instances of the SSBMO, based on the the 3rd party informal and formal feedback gathered during the evaluation activities (E2, E3, via items whose label includes "FI" – Feedback on Instances).

From this feedback it appears that the descriptions of Timberland and the case firms were perceived by the respondents as novel from previous descriptions of those firms business models experienced by the respondents. This assertion, subject to the opportunities for improvement identified by the respondents, is supported by the feedback on the novel utility of the instantiations by the respondents (8.7.3).

[8] Although some were explicitly verified as a result of evaluation activity E1b, Table 8-4.

10.6.6 Other Noteworthy Contributions

In both the proto-theory for the conditions required for a sustainable organization (4.7.2) and the proto-principles of business model design (7.7), a number of frameworks were referenced that differentiate themselves by their attempt to describe the conditions for or measurement of human social and / or organizational strong sustainability. They were included in the theory and principles because they offer researchers and business model designers useful additional detail to that offered here. These frameworks, described earlier, are:

- The Alliance for Strategic Sustainable Development's[9] Framework for Strategic Sustainable Development five Level Framework, four Sustainability Principles and three prioritizing principles
- Comparison International's PROmoting Business Excellence (PROBE, developed with The Natural Step)[10]
- The Benefit Impact Reporting System (BIRS) and the Global Impact Investment Rating System (GIIRS), developed by B Lab[11]
- The Business Alliance for Local Living Economies (BALLE) Localist Values[12]

The overall goal of the organizations that create and maintain these frameworks is to create more sustainable organizations, and to move society toward a resilient strongly sustainable attractor. To do this they attempt to have existing organizations, communities and countries, make practical changes that are in conceptual alignment to their frameworks. Depending on the current state of the framework user's organization, this may require them to undertake efficiency changes, larger substitutions or whole scale re-design. (Hill & MacRae, 1996).

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[9] http://www.alliance-ssd.org/
[10] http://www.comparisonintl.com
[11] http://www.bcorporation.net and http://giirs.org/
[12] (Business Alliance for Local Living Economies (BALLE), 2012)

However, until the existence of the SSBMO and the SSBMC it powers, none of these frameworks has been able to concisely provide a response to the typical questions from those framework user's:

- How can I be certain that my organization's business model is aligned with this framework?
- What are the necessary and sufficient topics or questions I must respond to in order to be aligned with this framework?
- What tools can help me describe, communicate, discuss, design, choose, invent, challenge, improve, innovate my business model while improving my adherence to this framework?

These frameworks have to varying degrees[13] been based on the same latest formal, natural and social science and key theoretical frames as the SSBMO and SSBMC (Chapters 1-4). Hence a significant practical contribution of the SSBMO and SSBMC is that they provide these organizations with their first rigorously defined ability to respond to the above questions from their frameworks' users.

In turn, as per the research objective (RO), this capability of the SSBMO and SSBMC, enables an increase the quality and efficiency of these persons application of each of these frameworks. In other words, more strongly sustainable businesses, whose designs adhere to these recognized frameworks, can be more efficiently created more reliably, consistently and effectively than before. This helps these organizations achieve their mission more efficiently and effectively: creating more human flourishing.

[13] The Framework for Strategic Sustainable Development was rigorously so defined; PROBE was based on this framework. The other frameworks were not rigorously defined, but it is clear from their content that the persons who created them are well aligned with the strongly sustainable world-view and share an overall understanding of the key theoretical frames. For example the researcher became familiar with the B Lab Impact Assessment Survey items during its use in evaluation activity E1b.

10.7 Summary and Closing Thoughts

This section summarizes all these contributions using the structure provided by Table 3-5, and offers a brief reflection on the significant findings, novelties and contributions to the knowledge base presented in this chapter. Table 10-2 provides this summary.

		Design Science Research Activity Streams		
	Output Elements	P. Prepare	D. Build (Develop / Design)	E. Evaluate (Validate)
Design Science Research Output	i. Constructs	Rigorous understanding the Problem and related Definitions (10.2, 10.3, 10.4, 10.5)	Rigorous definition of constructs (10.4, 10.6)	Rigorous definition of metrics (10.4)
	ii. Models	Rigorous identification of ontology design principles which relates the definitions (10.4, 10.5)	Rigorous coding and capture of all the construct inter-relationships (10.4, 10.6)	Rigorous relation of metrics to research question and objective (10.4)
	iii. Instantiations	None	None	Novel instantiations of existing business (10.6)
	iv. Method	Improvements in (systemic) design science, ontology engineering and soft systems preparation activity design (10.4)	Improvements in (systemic) design science, ontology engineering and soft systems build activity design (10.4)	Improvements in (systemic) design science, ontology engineering and soft systems evaluation activity design (10.4)
	v. Better Theory	Proto-theory of the Conditions Required for the Emergence of Strongly Sustainable Organization (10.5)	Proto-Principles for the Design of Strongly Sustainable Organizations (10.5)	None

Table 10-2: Summary of Key Contributions of this Design Science Research
(Structure of table from Table 3-5)

Returning to one of the opening statements of this research (2.1), "the value I believe this research will have for managers is its usefulness: 'I'm going to help you be more effective at designing a high quality model of your business that increases the likelihood that it will be environmentally, socially and monetarily sustainable'. This is an improvement over what has existed up to this time, which has not included attempts of formally structuring conceptions of sustainability based on the applicable scientific knowledge within business models".

This chapter has demonstrated this research's significant contributions related to:

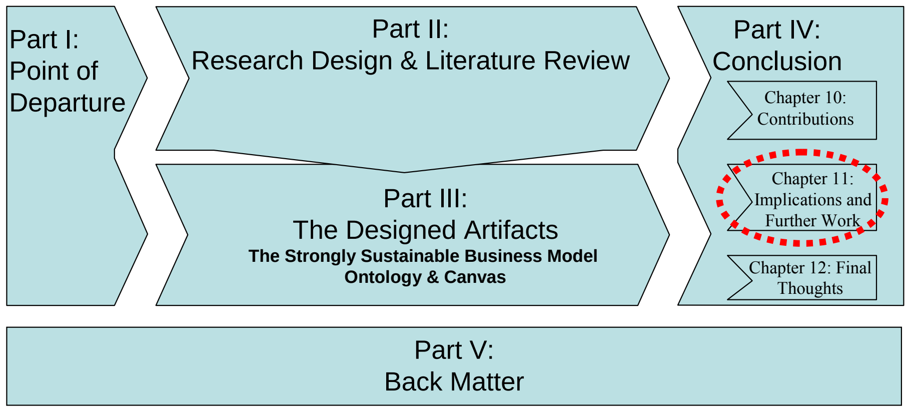
- Understanding of the problems involved in creative this value for managers
- Rigorously defining the required concepts based on the applicable science,
- Rigorously identifying and applying the methods to maximize research output legitimacy.

As a result this research has demonstrated that it can help, and has further potential to help, realize this value in practice for managers.

If others have offered these contributions earlier, but I have failed to find them I offer my humble apologies and welcome the correction.

Chapter Eleven: Implications and Further Work

I hold that man is in the right who is most closely in league with the future — Ibsen



Having identified and substantiated which parts of this research are significant findings, novelties and contributions to the "knowledge base" (Figure 3-19) this chapter seeks to respond to the question: what could be additional areas of research that could confirm, refute or build upon these contributions.

11.1 Introduction

In selecting the exploratory approach to this research it was recognized that "it will be for subsequent research to take [its] output and use it for description, theorizing and formal/quantitative justification / testing" (3.2.3.1).

This exploratory research has broadly confirmed the utility of the SSBMO and the SSBMC it powers (8.9). However, based on the opportunities identified during evaluation (8.4-8.8, GR1-11 and GU1-11), and as described in Chapter 9, much work remain to be done to substantiate this result and improve the reliability of the generation of this utility (9.2-9.3, CR1-8 and CU1-5).

In addition, a number of limitations were designed into the artefacts (2.6, L1-7) that, based on the feedback, clearly impact artefact utility.

Further, there are many related problems identified during the research that need to be tackled in order to equip managers of organizations with all the knowledge and the best tools to enable them to efficiently, reliably, consistently and effectively contribute to the resolution of the Global Problématique (1.2.1).

As described in Chapter 3 (Figure 3-5 and 3.5.2-4), in addition to the output of this research, the fastest way to fully equip managers with this missing knowledge would be through an innovative and explicit research agenda. Such a research agenda would appropriately use and integrate both systems oriented descriptive and design science, while using a range of research conceptual frameworks (Figure 3-2).

Proposing a research agenda that might start to address these limitations and gaps in the knowledge base was inspired by similar offerings made by the exemplar ontology researchers (Al-debei & Avison, 2010, pp.227-230; Bullinger, 2008, pp.344-345; Osterwalder, 2004a, pp143-158).

Finally, as noted in 10.2.3, the field of this research project has clear intersections with a number of other fields. However, it also makes a contribution by suggesting that it is situated within an entirely new field of research: the applied field of strongly sustainable business models and modelling (Upward, 2012a). In proposing a research agenda for this possible new field of research, this chapter is also a contribution to the knowledge base.

11.1.1 Chapter Structure

This chapter suggests future areas of research that complement and extend the results of this project, and is structured as follows:

- Section 11.2 reviews the limitations that practically impacted this research project, and hence help identify techniques future researchers may wish to consider to avoid these limitations.
- Section 11.3 positions this chapter's suggestions for future research amongst existing research agenda proposed by researchers from some of the disciplines identified in key theoretical frames.

The remaining sections use the broad understanding of the structure of organization sustainability knowledge creation and legitimization discussed in Chapter 3, to categorize the proposed future research agenda as follows:

- Section 11.4 introduces all the proposed research agenda items and suggests potentially valid epistemic modes for each. Further each item is linked to one of the research question (RQ), objectives (RO), research conceptual framework (critical pragmatism) and chosen epistemological approach (systemic design science), working definitions, identified candidate changes in research rigor (CR), candidate utility (CU) or designed limitations (L).
- Section 11.5 highlights specific aspects of the proposed research agenda items in areas of the knowledge base that could be usefully enhanced through the descriptive science theory development epistemic mode (and subsequent justification).
- Section 11.6 highlights specific aspects of the proposed research agenda items in areas of the knowledge base that could be usefully enhanced through the descriptive science justification epistemic mode. A number of potentially testable hypothesis are suggested.
- Section 11.7 highlights specific aspects of the proposed research agenda items in areas that could increase the utility available to strongly sustainable business model designers through the use of the design science epistemic mode, i.e. using the design and evaluation of artefacts to:
    - Increase efficiency and effectiveness, improving the utility of the artefacts first created by this research, based on:
        - The candidate changes for research rigor and artefact utility described in Chapter 9.
        - Removing the limitations on the artefacts created by this research (2.6).

- Create new types of artefacts by reimagining the problem and solution spaces (redesign).

- Section 11.8 highlights specific aspects of the proposed research agenda that could add to the knowledge base using the action research epistemic mode. Such research could practically exploit the results of this research, helping in a small way to resolve the Global Problématique, and complement both the suggested descriptive and design science research agendas.

  This section also reviews the work planned to be undertaken by the action research oriented Strongly Sustainable Business Model Group from the Faculty of Design's Strategic Innovation Lab at the Ontario College of Art and Design University[14].

11.2 Realized Limitations

11.2.1 Introduction

This section reviews the limitations that practically impacted this research project, and hence identify techniques that future researchers may wish to consider to avoid these limitations.

These limitations are in addition to the many designed limitations (L1-7, 2.6).

11.2.2 Time, Resources and Funding

The three practical limitations to all human endeavours limited this research:

1. Available hours in the day, limited by physical and mental capacity.
2. The period of time available, limited by the socio-economic need for a 'living-wage'.
3. The number of persons able to spend time working on this research, limited by the availability of funds to pay them a 'living-wage'.

The ultimate impact of these two limitations on research rigour and output legitimacy is perhaps best judged by others. However, as noted in Chapter 9, all the candidate changes in research rigor would require more research time.

[14] http://slab.ocad.ca/the-strongly-sustainable-business-model-group-ssbmg, http://www.SSBMG.com

Further, the lack of funds to engage other researchers and respondents limited the ability to employ known best methodological practices (9.2.3 and 9.2.5).

11.2.3 Researcher Meta-Bias

As described in the literature, self-reflection, if done thoroughly and consistently, helps to identify and mitigate many typical sources of researcher bias. The attempt to take a critical pragmatic philosophical stance in this research (3.2.3.2) has the advantage of further highlighting the need for continuous critical reflection by the researcher at all stages of the project. In this research, undertaking such reflections were embedded in every facet of the process of designing and conducting the research (II-2). Further, the results of the many of these reflections are recorded throughout this thesis.

However, the only certainties are that that the bio-physical world will always be in a process of change and that human values will also always be in a process of change (3.4.6.1). Hence, the researcher's values are no exception: they too will also always be changing. Indeed, one might argue that the result of undertaking an education may be best judged by the degree and depth to which the experience changes one's world-views (3.5.1.5 Achieving the Generic Benefits of Ontologies).

As a result, the biases of the researcher undertaking the reflections will necessarily not be constant nor consistent over the time period during which the research is being undertaken. In other words, the world-view from which each reflection is undertaken will change during and be changed by the research process, i.e. a hermeneutic process (3.2.3.2).

The degree of self-awareness, time and effort to understand the impact of this process, and then to overcome this source of meta-bias is believed to be significant. Other than this short identification of this challenge, such an effort was not consciously made during this research.

11.2.4 Alignment of Artefact Capture Formalism and Research Problem

As the research progressed, and the understanding of the problem and solution space developed (7.4.3.4), it became increasingly apparent that there is tension between:

- The necessarily subjectivist 'reality' of the function, structure, process and context of multi-minded human organizations (3.5.4.3) and
- The necessarily positivist 'reality' of both
  - The ultimate biophysical context of human organizations (3.5.3) and
  - The Entity Relationship Modelling formalism chosen for the capture and coding of the strongly sustainable business model ontology (5.2.6).

It is uncertain the meaning to be assigned to the lack of feedback from respondents on this tension. At least two conclusions are possible:

1. That as a society, our increasingly positivist stance resulting from an ever increasing use of (digital information) technologies is lessening awareness of the subjective nature of human experience.
2. That the ability of the SSBMO to using normal language to create instances of its entities, enables the subjective, highly fungible and personally variable world-views of firm stakeholders, their needs, relationships, value delivery mechanisms and value propositions, to be adequately captured.

The ultimate impact of this limitation on research rigour, output legitimacy and utility is perhaps best judged by others.

11.3 Contributing to a Wider Research Agenda

11.3.1 Introduction

This section positions the suggestions for future research amongst existing research agenda proposed by researchers from some of the disciplines identified in key theoretical frames.

As noted in 10.2.3, this research suggests that it is situated within a new field of research. However, when proposing a research agenda for a new field, it is important to recognize that the fields of research intersected by this research each have considerable existing research agenda. These agenda relate to both this research's chosen epistemology (systemic design science) and parts of the key theoretical frames of this research, most specifically business models (operations management, management information systems, business strategy and innovation).

While many, if not most, of the literature reviewed include suggestions for further research, a small number of articles make significant proposals in their respective fields. The remainder of this section discusses these works, whose proposed research agenda intersect to varying degrees with the suggestions made in latter sections of this chapter.

The contributions of this research (Chapter 10) follow and align to many aspects of the research agenda set out in the following works; in some cases aspects of this research was directly inspired by their call to arms.

11.3.2 Profit-First Business Model Research Agenda

As discussed in depth in 4.4.5.3, there is a recent but growing agenda, based on the neo-classical profit-first world-view, related to business models and business modelling. While constrained in applicability to the new field by its implicitly assumed profit-first world-view, research that follows these agenda may still contribute to the closing of a number of the methodological and theoretical gaps identified (10.3).

From an explicit design perspective, in 2002 Osterwalder suggested the complete set of useful artefacts enabled by his Business Model Ontology (Figure 4-9). This included

Pigneur's 2001 identification of the value of research to create a catalog of electronic business model patterns, that, perhaps following Malone et. al. (Malone, Crowston, Lee, & Pentland, 1999), he labelled an "e-Business Model Handbook" (Pigneur, 2001).

Three years later Pateli and Giaglis proposed "an agenda for future research on business models" that included all these artefacts as well as making complementary suggestions for additional conceptual, theoretical and methodological research (Pateli & Giaglis, 2004, p.312 Table 3). Osterwalder and Pigneur substantially aligned with this proposal in their review of the benefits that may accrue to organizations that formally describe their business model (Osterwalder & Pigneur, 2005).

The following year Lambert proposed a "Business Model Research Schema", including areas requiring epistemological development (which she labels the "the inductive-deductive research cycle"). She also included areas requiring further design and descriptive research (development and application of a business model classification scheme, including a taxonomy and typology of business models, leading ultimately to the development of a "business model theory") (Lambert, 2006).

Finally in their comprehensive review of all the business model literature to that date, explicitly considering e-Commerce, Strategy and Technology & Innovation Management perspectives, Zott et. al. (Zott, Amit, & Massa, 2011b; Zott, Amit, & Massa, 2011a) suggest the following avenues for future research in business models:

- Better definitions, recognizing the multitude of perspectives that researchers have on business models, business modeling and its value (Zott, Amit, & Massa, 2011b, p.24).
- Given that business models are "a new unit of analysis, a systems-level concept, centred on activities, and focusing on value" (p.25) a more explicit use of descriptive science truths from related fields to build more robust constructs.

11.3.3 Ontology Engineering

In their 2009 article "Ontology Design Patterns", Gengemi and Presutti describe the value of a typology of "ontology design patterns" and a catalog / repository of such patterns (Gangemi

& Presutti, 2009). However, they conclude by stating "there is still a lot of work to be carried out populating repositories of patterns, discovering or extracting them from existing ontologies, assisting users in their application, defining a robust semantics and algebra for them, etc. The larger context of ontology design research is still very young and many ideas are just emerging. […] In a larger report and by setting up http://www.ontologydesignpatterns.org [where the report is located], we make some steps towards the open issues" (p.240).

11.3.4 Management Information Systems, the Bio-Physical Environment and Society

Finally, in the last few years a number of researchers in the Management Information Systems discipline have started to recognize the implications of the shift to the "systems age" on their existing research agenda.

Unsurprisingly, as a result, this has led to a spate of articles and new journals advocating for and reporting on the inclusion of the ultimate contexts relevant to all fields of inquiry on planet earth. Specifically, albeit to varying degrees, these research agenda all suggest that the bio-physical environment and human society this it hosts be explicitly included in their field's research agenda.

Examples include:

- The Management Information Systems Quarterly article "Information Systems Innovation for Environmental Sustainability" proposing a comprehensive research agenda for the integration of the bio-physical into management information systems research (Melville, 2010).
- The Communications of the Association of Information Systems article, "Green Information Systems: Concepts and Issues for Information Systems Research" (Dedrick, 2010).
- The 2011 launch of the journal, "Sustainable Computing: Informatics and Systems"[15]

[15] http://www.sciencedirect.com/science/journal/22105379/1/4

- The Communications of the Association of Computing Machinery article “Information Technology and Gross National Happiness” (Heeks, 2012).
- The Communications of the Association of Computing Machinery article “An Information Strategy for Environmental Sustainability” (Watson, Corbett, Boudreau, & Webster, 2012).
- An edited monograph “Computing Research for Sustainability” (Millett, Estrin, & National Research Council (US) Committee on Computing Research for Environmental and Societal Sustainability, 2012).

11.4 A Research Agenda for the New Field of Strongly Sustainable Business Models

This research agenda has been constructed with the wider research agenda reviewed above in mind (11.3). This was accomplished through an analysis and synthesis of the contributions (Chapter 10), the research question (RQ), objectives (RO), research conceptual framework (critical pragmatism) and chosen epistemological approach (systemic design science), working definitions, the identified candidate changes in research rigor (CR), candidate utility (CU) and the designed limitations (L).

Inspired by the structure of Table 3-5 and the epistemic modes described in Figure 3-5, Table 11-1 introduces each proposed item in a research agenda for the possibly new field of strongly sustainable business models. For each item the suggested possible epistemic mode of inquiry is suggested. A key follows the table to explain the applicable epistemic modes of inquiry identified as relevant.

Label	Description of Possible Research Agenda Item	Applicable Epistemic Mode			
		Design Science Build & Evaluate	Descriptive Science: Theory Develo p-ment	Descriptive Science: Justifi-cation [16]	Action Re-search
	Research Objective and Question See Chapter 2 and 3 for Detail				
RQ	Confirm benefits of ontologies – provides a common language (3.5.1.3)	✓		TH1a	✓
RQ	Confirm benefit of ontologies – non-prescriptive access to key theoretical frames (3.5.1.5)	✓		TH1b	✓
RO0	An independent review and synthesis of the literature of organizational strong sustainability leads to substantially similar overall and detailed ontology and canvas design principles (Chapter 3, and 4.4-4.6)	✓		TH2	
RO0	Any ontology of strongly sustainable business models that adheres to the overall and detailed ontology design principles, and any visual design tool derived from such an ontology while adhering to the canvas design principles, will exhibit at least similar levels of utility as the SSBMO and SSBMC respectively (Chapter 5)	✓		TH3a	✓
RO0	An independent repetition of the evaluation research design (following the closure of the gaps in research rigor – CR1-8) would yield substantially similar results (Chapter 6)	E		TH3b	
RO0	An independent application of the process that produced the summary visualizations produced from the detailed formal diagrammatic representations of the SSBMO would yield substantially similar visualizations (5.4.5, 5.4.6)	✓		TH3c	✓
RO1 &2	Confirm the finding of this research that a SSBMO based visual design tool (following the application of CU3-5 to the artefacts design) can help business model designers more quickly understand strongly sustainable business models and the relationships between their constructs and contexts	E		TH4a	✓
RO1 &2	Determine whether the SSBMO, SSBMC and their future simplifications (following the application of CU3-5 to the artefacts design) enable a strongly sustainable business model designer to change focus, ignoring now irrelevant complications that appeared in the BMO, and hence the net cognitive load in using the SSBMO and the SSBMC it powers remains unchanged compared to the BMO and the BMC it powers	✓		TH4e	✓

[16] In some cases a possible draft Testable Hypothesis (TH) are suggested; these are described in section 11.6, labelled TH1-n.

Label	Description of Possible Research Agenda Item	Applicable Epistemic Mode			
		Design Science Build & Evaluate	Descriptive Science: Theory Develo p-ment	Descriptive Science: Justifi-cation	Action Re-search
	Research Framework and Epistemology[17] **See Chapter 3**				
FE1	Continue the theorization and justification of the critical pragmatist philosophic conceptual framework (3.2)	✓	✓	✓	✓
FE2	Continue the theorization and justification a philosophically critically pragmatic methodology of systemic design science (Chapter 3-6)	✓	✓	✓	✓
	Definitions, (proto) Design Principles, proto-Theory[18] **See Chapters 3, 4 and 7**				
FD1	Continue work to fully theorize and justify definitions of social (macro) and organizational (micro) strong sustainability, value, value creation and value destruction (Chapters 3 and 4)	✓	✓	✓	✓
FD2	Continue the theorization and justification of the overall and detailed ontology design principles (ODP1 & 2, DDP1-6) and canvas design principles (CDP1-3) (Chapter 3, and 4.4-4.6)	✓	✓	TH3a	✓
FD3	Continue the theorization and justification of a "theory for conditions required for a strongly sustainable organization" (TSSO0-5, 4.7.2)	✓	✓	✓	✓
FD4	Continue theorization and justification of design principles for strongly sustainable business model designs (pBDP0-5, 7.7, also part of over coming limitation L7)	✓	✓	✓	✓
FD5	Continue theorization and justification of SSBMO constructs (entities) and model (entity inter-relationships) (Chapter 7)	✓	✓	✓	✓
FD6	Continue theorization and justification of SSBMO construct details (entity attributes) (Chapter 7)	✓	✓	✓	✓
FD7	Continue theorization and justification of a theory of Tri-Profit, including a Tri-Profit calculus that provides decision rules for managers (7.4.5.3)	✓	✓	✓	✓

[17] These items labelled FE1..n = Further Epistemological research agenda item.
[18] These items labelled FD1..n = Further Definitional research agenda item.

Label	Description of Possible Research Agenda Item	Applicable Epistemic Mode			
		Design Science Build & Evaluate	Descriptive Science		Action Re-search
			Theory Develo p-ment	Justifi-cation	
	Candidate Changes in Research Rigor (RO0) See Section 9.2 for Detail				
CR1	Repeat evaluation activities of this research with additional respondents with low expectations of the utility of business modelling and / or profit-first world view	E			✓
CR2	Amend the research design to include focus groups to use the CATWOE technique to construct comparator knowledge concerning: ● The definitions of the constructs and model for the SSBMO (E1a) ● The instantiation of the SSBMO expressing The Timberland Company's Business Model (E1c) ● The instantiation of the SSBMO expressing each case firm's business model respectively (E3) Use results to confirm or refute validity of all constructs and inter-relationships in the SSBMO.	E			✓
CR3	Enhance evaluation through the use of additional comparator knowledge sources (PROBE, The Good Analyst, Network for Business Sustainability report on stakeholders, relationships and partnership)	E			✓
CR4	Use a range of mechanisms to further reduce bias in the evaluation activities – addition investigator for comparative analysis and in interviews (and subsequent analysis / synthesis)	E			
CR5	Formally test the briefing presentation used during evaluation activities with additional respondents who have a range of world-views prior to use as part of the evaluation protocols to gather comparator knowledge	E			✓
CR6	Add an additional evaluation technique, a 'natural experiment', to gather a new type of comparator knowledge	E		✓	✓
CR7	Add more formalized triangulation techniques for cross-case and cross-evaluation activity groups	E			
CR8	Map the chosen metrics to Cleven's evaluation functions and evaluation perspectives and then subsequently using this mapping confirm that the chosen metrics fully cover all possible categories of utility	E			

Label	Description of Possible Research Agenda Item	Applicable Epistemic Mode			
		Design Science Build & Evaluate	Descriptive Science		Action Re-search
			Theory Develo p-ment	Justifi-cation	
	Candidate Changes in Artefact Utility (RO1-2) **See Section 9.3 For Detail**				
CU1	Add the following attributes to the Need and Criterion entities ● Earliest time horizon in which need must be met to create value, and avoid value destruction. ● Latest time horizon, after which not meeting a need will lead to value destruction.	✓			
CU2	Amend the constructs and relationships to include the commonly understood elements of leadership frameworks as entities in the SSBMO and include the relationship of these entities to the existing entities.	✓			✓
CU3	Find a better way to provide a more accessible introductory visualization of the SSBMC	✓			✓
CU4	Improve labels for the decision entity to better resonate with business model designers	✓			✓
CU5	Create a non-burdensome mechanism (or process in an accompanying methodology for the effective and efficient use of the SSBMO, L6) to trigger a business model designer to consider and record, or design, the business network of which the focal firm is a part	✓			✓

Label	Description of Possible Research Agenda Item	Applicable Epistemic Mode: Design Science Build & Evaluate	Applicable Epistemic Mode: Descriptive Science – Theory Develo p-ment	Applicable Epistemic Mode: Descriptive Science – Justifi-cation	Applicable Epistemic Mode: Action Re-search
	Remove the Following Designed Limitations to Artefact Utility (RQ, RO1-2) See Section 2.6 for Context				
L1	The inability to model changes to a business model over / through time	✓	✓	✓	✓
L2	Details of the business process designs required to execute an implemented business model	✓	✓	✓	✓
L3	Modelling human organizations that do not attempt to create a net monetary profit (e.g. NGO, government, regulators, etc.)	E		TH5	✓
L4	Use of the SSBMO and SSBMC in a design setting or mode, i.e. their use to create new / changed business designs inspired by new / changed strategies	E		TH4c	✓
L5	Longitudinal evaluation of the efficiency of creating high quality (reliability, consistency, effectiveness) results using the SSBMO and the subsequent implementation of those instantiations, i.e. evaluating the sustainability outcomes of businesses implemented from business models created using the SSBMO	E		TH4d	✓
L6	Building and designing a process (a design methodology) that incorporates the use of the SSBMO and SSBMC to ● Enable the effective diagnoses of business model weaknesses when compared to the strongly sustainable business design principles (added from 9.3.6) ● Create high quality (reliable, consistent, effective) business model designs ● Create an operating business from a strongly sustainable business model design ● Maximize the efficiency of business model designers diagnosing, creating and implementing strongly sustainable business models	✓		TH4b, c & d	✓
L7	The definition of the design principles for strongly sustainable business models, descriptions of patterns of strongly sustainable business models, metrics for the measurement of an operating business against such principles and patterns, and threshold values of the metrics that identify the minimal level of adherence to the principles and patterns that would allow a business to claim it was strongly sustainable.	✓	✓	✓	✓

Table 11-1: The Research Agenda for the New Field of Strongly Sustainable Business Models

Key for Table 11-1			
✓	It is appropriate to undertake this possible research agenda item using this epistemic mode		
E	It is appropriate to undertake this possible research agenda item using the evaluate activity stream within the design science epistemic mode	THx	It is appropriate to undertake this possible research agenda item using a descriptive science justification epistemic mode; A possible draft Testable Hypothesis is suggested in 11.6.

Unsurprisingly many of the research agenda item seek, in normal scientific fashion, to confirm the results of this research, or to generalize the results of this research.

The remaining sections of Chapter 11 highlight specific aspects of the proposed research agenda items (including suggesting wording for the Testable Hypotheses), grouped by epistemic mode. This is a selective not an exhaustive review of all the possibilities suggested in Table 11-1.

11.5 Descriptive Science Theory Development

This section highlights specific aspects of the proposed research agenda items (Table 11-1) in areas of the knowledge base that could be usefully enhanced through the descriptive science theory development epistemic mode (and subsequent justification).

This section provides commentary on a number of the research agenda items from the perspective of theory development (and justification): FEx, FDx[18] and Lx listed in Table 11-1.

FE2: Continuing the theorization and justification of a philosophically critically pragmatic methodology of systemic design science should include the full theoretical integration of systems thinking and the science of design (Chapter 3-6). This could lead to a research method that has all the features of a “Third Generation” systems and design methodology as proposed by Pourdnhad et. al (Pourdehnad, Wexler, & Wilson, 2011a; Pourdehnad, Wexler, & Wilson, 2011b) (3.6.3).

The research agenda items labelled FD include the work necessary to keep all the definitions, principles and theory up to date with the ever improving literature which describes the key theoretical frames (3.6.6):

- The contexts for all organizations: formal science, natural science, ecological- macro-sociology and macro-economics.
- The parts of all ideal-seeking multi-minded purposeful systems (human organizations): ecological- micro-sociology (organization development & design, leadership, management etc.), micro-economics (finance, accounting, reporting, etc.) and the related fields of innovation, strategy, operations management and management information systems.

FD1: Continue work to fully theorize and justify definitions of social (macro) and organizational (micro) strong sustainability, value, value creation and value destruction (Chapter 3, and 4.4-4.6). This could include:

- Ensuring the relationship of these definitions to emerging standards of strongly sustainable business are understood (7.7.7).
- Extending the Delphi research on the definition of organization sustainability started by Doig (Doig, 2003).

FD3: Continue the work to fully theorize and justify a "theory for conditions required for a strongly sustainable organization" (TSSO0-5, 4.7.2). This could include:

- Development and justification of a theory of maturity of societies and the process of their movement towards (or away) to these conditions. A basis for such a model may be found in the works of Tainter, Diamond and Morris (Diamond, 2005; Morris, 2010; Tainter, 1988) and may be informed by the application of non-equilibrium thermodynamics to human societies (3.5.3.1 Understanding Organization's Context Systemically).

- Development and justification of a theory of maturity of strongly sustainable businesses and the process of their movement towards (or away) to these conditions. This would expand upon / justify the validity of the maturity model proposed by Hill, Willard and (to a lesser extent) Doig (Doig, 2003; Doig, 2009; Hill & MacRae, 1996; Willard, 2012, Fig 1.15 pp.20-21) (7.7.8).

FD5 and **FD6**: Continue the work to fully theorize and justify the constructs, their attributes and their inter-relationships in the SSBMO (Chapter 7). This could include:

- Confirming the theoretical and practical legitimacy of the constructs and the model which is suggested inter-relates them.
- Confirming the theoretical and practical legitimacy of the attributes and the possible values proposed (7.4)

This could be achieved through the use of the CATWOE technique (CR2).

L2: Theorize the details of the business process designs required to implement and execute a business model so that strongly sustainable outcomes do in-fact emerge. An earlier research proposal may be of assistance in this work, through its review of the current state of knowledge concerning business process design, which is only lightly summarized in this thesis (Upward, 2009).

L7: Theorize the definition of the principles for strongly sustainable business models, descriptions of patterns of strongly sustainable business models, metrics for the measurement of an operating business against such principles and patterns, and threshold values of the metrics that identify the minimal level of adherence to the principles and patterns that would allow a business to claim it was strongly sustainable.

It is suggested that patterns of strongly sustainable business models are a type of theory, one to which the SSBMO can provide a taxonomic structure (3.5.1.3 Parts of an Ontology). Hence the development of a catalog of such patterns of strongly sustainable business model design may be considered, at least initially, a theoretical exercise.

Such work could build on work on patterns of ontologies and business models by Gengemi, Ramaprasad, Pignuer, Malone and Carr (Carr, 1999; Gangemi & Presutti, 2009; Malone et al., 1999; Malone, Crowston, & Herman, 2003; Malone et al., 2006; Pigneur, 2001; Ramaprasad & Papagari, 2009).

Further, work on defining a standard for strongly sustainable business, the definition of metrics and threshold values of those metrics, should include collaborating with existing practitioner attempts to build and justify such a standard (7.7.7).

11.6 Descriptive Science Testable Hypotheses

This section highlights specific aspects of the proposed research agenda items (Table 11-1) in areas of the knowledge base that could be usefully enhanced through a descriptive science justification epistemic mode.

This section provides commentary on a number of the research agenda items listed in Table 11-1 from the perspective of theory justification (labelled THx). A number of the suggested potentially testable hypotheses are expanded upon below. Suggesting testable hypothesis follows the lead of Osterwalder, who offered a set of testable hypothesis at the end of his PhD thesis (2004, p.138). In turn this was inspired by advice from one of the earliest works on design science in the information systems field (March & Smith, 1995).

Many of these testable hypothesis seek to use descriptive science to justify (and revise as appropriate) the many potentially theoretical contributions in this research (10.2, 10.5 and 10.6).

TH1: A SSBMO based visual design tool:

a. Creates a common language to address strongly sustainable business models, improving communications (problem solving and innovation). This hypothesis is intended to confirm one of the generic claimed benefits of ontologies, that they provide a common language for communication and that this has utility. Despite this assertion being made in the literature, no empirical studies were found to substantiate this assertion (3.5.1.3).

b. Enables the world-view of business model designers to change through their incorporation of knowledge from the key theoretical frames upon which the ontology is based. This hypothesis is intended to confirm one of the generic claimed benefits of ontologies, that they enable non-prescriptive access to key theoretical frames and that this has utility. Despite this assertion being made concerning this, no empirical studies were found to substantiate this assertion (3.5.1.5)

   The latter hypothesis was suggested by Prof. David Johnston, who also proposed one possible descriptive science approach to conducting such research: "I can also see why you have almost another doctoral thesis testing different ways of communicating business modeling from an education perspective. Using traditional entrepreneurial cases studies you could do controlled experiments to test the effectiveness of changing metal models about business development using your framework as the intervention"[19]

These hypotheses, if confirmed, would lend further support to the validity of the research question (RQ) and the chosen designed artefact (3.5.1).

TH3a: Any ontology of strongly sustainable business models that adheres to the overall and detailed ontology design principles, and any visual design tool derived from such an ontology while adhering to the canvas design principles, will exhibit at least similar levels of utility as the SSBMO and SSBMC respectively (Chapter 5). This is based on the contribution asserted in 10.5.5.

This hypothesis, if confirmed, would lend further support to the ontology overall and detailed design principles (FD2).

TH4: Compared to other tools, a SSBMO based visual design tool can help business model designers more quickly:

a. Understand strongly sustainable business models and the relationships between its elements and their contexts.

[19] Email communication, November 23, 2012.

This hypothesis, if confirmed, would lend further support to the research objective (RO1 & 2).

b. Diagnose problems with business models which prevent them from enabling strongly sustainable outcomes.

c. Efficiently design high quality strongly sustainable business models.

d. Efficiently implement strongly sustainability business models, resulting in operating businesses that reliably enable strongly sustainable outcomes.

These latter three hypotheses, if confirmed, would lend further support to the research objective (RO1 & 2) and would confirm the utility of a methodology for the efficient and effective use of the SSBMO (i.e. that limitations L4, L5 and L6 are overcome).

The latter hypothesis was inspired by a similar suggestion by Osterwalder, who noted, "testing [such a] hypothesis is not an easy task and constitutes an entire research [project] in itself [… requiring] observing a management team over a period of time before introduction the business model ontology. In a first ethnographic-like step one would have to try to assess communication style and discussion quality and in a second step one could apply the business model ontology and analyze the change." (Osterwalder, 2004a, pp.141-142).

Further enabling business model designers to more quickly understand, diagnose, design and implement strongly sustainable business models, specifically when compared to the BMO and the BMC it powers, an SSBMO based visual design tool:

e. Enables a strongly sustainable business model designer to change focus, ignoring now irrelevant complications that appeared in the BMO, and hence the net cognitive load in using the SSBMO and the SSBMC it powers remains unchanged compared to the BMO and the BMC it powers

   This hypothesis, if confirmed, would lend further support to the research objective (RO1 & 2). See further discussion in 7.2.1.3 and 7.5.3 and 8.10.

TH5: Confirm generalizability of the SSBMO to all human organizations. The SSBMO and SSBMC were explicitly constrained by the requirement to describe the business models of for-profit organizations.

This hypothesis seeks to confirm that the SSBMO is not limited in its applicability to profit-first organizations. This seems probable because the SSBMO was designed to conceptualize:

a. Any group of stakeholders and their needs, who believe that their involvement in a firm can best meet those needs. This appears to apply to any type of human organization.

b. All organizations in the business network of the focal firm, including non-profit organizations such as NGOs, governments, regulators, families and communities.

c. Any definition of success in any unit of measurement deemed by the legitimized stakeholders of the focal organization to be valid – not just monetary profit.

11.7 Design Science to Increase Artefact Utility

This section highlights specific aspects of the proposed research agenda items (Table 11-1) in areas that could increase the utility available to strongly sustainable business model designers through the use of the design science epistemic mode, i.e. using the design and evaluation of artefacts to:

- Increase efficiency and effectiveness, i.e. improving the utility of the artefacts first created by this research, based on:
  - The candidate changes for research rigor and artefact utility described in Chapter 9 and listed in Table 11-1 (CR1-8 and CU1-5, respectively)
  - Removing the limitations on the artefacts created by this research described in 2.6 and listed in Table 11-1 (L1-7)
- Create new types of artefacts by reimagining the problem and solution spaces.

These possible research agenda items are structured using the efficiency-substitution-redesign (ESR) framework of Hill and MacRae (2.5, #5). This is thought a valid framework to categorize the nature of the likely impact of the proposed research agenda items in the design science epistemic mode.

11.7.1 Efficiency: Close Gaps Identified in Existing Artefacts

The evaluation activity stream candidate to changes to research rigour and artefact utility (Chapter 9, CR1-8 and CU1-5, respectively) ought, once made, increase the utility of the existing artefacts described in Chapter 7 and the supplementary materials (SM3-5).

Work to remove the impact of limitations L4 and L6 (use of the SSBMO, enhanced by the application of the candidate changes, in a diagnostic and design modes) would also increase the utility of the artefacts.

Further, work to confirm that limitation L3 (applicability of the SSBMO, enhanced by the application of the candidate changes, to all human organizations), is not valid and disconfirm limitation L5 (longitudinal study of the utility of the SSBMO, enhanced by the application of the candidate changes, at creating strongly sustainable outcomes) would add weight to the results described in Chapter 8 and 9, and the contributions discussed in Chapter 10.

However, it seems unlikely that such changes will lead to dramatic increases in utility; the nature of diminishing returns of investing in any complex system being predominant (Allen, Tainter, & Hoekstra, 1999, p.14).

11.7.2 Effectiveness: Propose Significant Changes to Artefacts

Increasing utility further would require changes more significant than the evaluation activity stream was designed to identify. The evaluation activity stream was, by design, looking to enable single-loop learning. Some double-loop learning is required for further increases in artefact effectiveness (3.5.1.5 Achieving the Generic Benefits of Ontologies).

Such improvements could come as a result of improved theorization and justification of an enhanced:

- Critical pragmatist philosophic conceptual framework (proposed in 3.2, and as enhanced by the result of research agenda item FE1, Table 11-1)
- Philosophically critically pragmatic methodology of systemic design science (proposed in Chapter 3-6, and as enhanced by the result of research agenda FE2, Table 11-1)

Given the conceptual complexity of the problem, and the nature of the impact research results could have on SSBMO design, the following proposed research agenda items could all have a significant impact on its utility:

- Design and evaluation of definitions (FD1-6), and the removal of limitation L7, through the alignment of the of the SSBMO with any common scientifically defined conception of organizational sustainability, an associated methodology for its measurement along with required threshold values of the metrics.
- Design and evaluation of a theory of Tri-Profit, including a Tri-Profit calculus (a tool) that provides decision rules for managers (FD7, 7.4.5.3).

  During evaluation activity E2a-1 (8.6.2.2) it was suggested that the *i** framework[20] for the social modelling of requirements engineering (pronounced 'eye-star', Intentional Strategic Actor Relationship modelling framework) could form the basis for such a calculus and tool[21].

- Application of candidate changes to utility CU3 (find a better visualization).

  In addition to providing a "more accessible introductory visualization" for the SSBMO, this research could also take up the suggestion of a 3 dimensional visualization made by a number of the respondents (8.7.3.2, #6), as well as exploring

[20] (Yu, 2009; Yu, 2011)
[21] Further suggestions related to the development of such a calculus and the potential applicability made via personal communication from Prof. Rod MacRae concerning the work of Dr. Barry Wellmans (University of Toronto) and Dr. Nicole Klenk (former post-doc in York University Faculty of Environmental Studies).

the utility of a version of the tool enabled via various digital information technologies.

- Application of candidate changes to CU5 (better enable the visualization of business networks involved in a business model).
- Removal of limitation L1 (inability to model changes to a business model over time).

11.7.3 Redesign: Propose New Types of Artefacts with High Utility to the Problem

Further increases in utility would require some combination of significantly different visualizations and double-loop learning.

Such dramatic increases in utility could be the result of design science research by others that uses the overall and detail ontology and canvas design principles (ODP1 & 2, DDP1-6, CDP1-3) to produce alternative artefacts that adhere to the key theoretical frames (research agenda items labelled RO0 in Table 11-1**,** per contribution 10.5.5).

However it is also possible, depending on the nature of the resultant artefacts, that design science research that removes limitations L6 (use of the SSBMO, enhanced by the application of the candidate changes, in a diagnostic and design modes) and L7 (design principles, patterns and a standard for strongly sustainable business) could also dramatically increase the utility of the SSBMO artefacts (existing or revised).

11.8 Action Research to Gain Experience

This section highlights specific aspects of the proposed research agenda items (Table 11-1) that could add to the knowledge base using an action research epistemic mode. Such research could practically exploit the results of this research, helping in a small way to resolve the Global Problématique, and complement the output of both the suggested descriptive and design science research agenda.

This section also reviews the work actually planned to be undertaken by the action research oriented Strongly Sustainable Business Model Group from the Faculty of Design's Strategic Innovation Lab at the Ontario College of Art and Design University[22].

Several scholars have undertaken research in the field of business models and business modelling that might best be described as action or even participative action research, i.e. it includes an intervention involving the researcher that creates or changes phenomena in the real-world (Baskerville & Wood-Harper, 1996; Cargo & Mercer, 2008):

- Mertens et. al. undertook a case study as part of his efforts to design and evaluate a "method for business model development (Meertens, Iacob, & Nieuwenhuis, 2012)
- Lejune used Osterwalder's BMC to explore how this might be used to create a process of business model design (from both a weak and strong sustainability perspectives), through the design and evaluation of a "table game to capture the logic and emotions related to the design process of a Business Model" (Lejeune, 2012).
- Rohrbeck et. al. used Osterwalder's BMC to better understand the collaborative process of creating sustainability innovations while deigning new business models for a consortia of businesses in the German renewable energy sector (Rohrbeck, Konnertz, & Knab, 2013).

Such examples illustrate how removing limitations L4, L6 and L7 might be tackled using an action research mode. Discussion concerning the removal of these limitations has been a focus of the Strongly Sustainable Business Model Group and its forthcoming crowd-funded collaborative action research project. Based on this research, this project intends to produce and then widely deploy a toolkit for the design and implementation of strongly sustainable business models.

An overall 'theory of change' has been developed[23] which discusses how action research to develop and then enabled by this toolkit could both impact the Global Problématique and generate contributions to the knowledge base.

[22] http://slab.ocad.ca/the-strongly-sustainable-business-model-group-ssbmg, http://www.SSBMG.com

Within this context:

- Recently a SSHRC grant application entitled "Organizational System Design for Strongly Sustainable Business Models" in the priority research areas of Innovation, Leadership & Prosperity and Canadian Environmental Issues, was submitted to undertaken action research related to L6, a method for the creation of strongly sustainable business models.

- A number of case studies have been initiated in various places around the world with persons independent of the researcher. These people have begun to use the SSBMC in consulting engagements and / or the (re)design of business models to increase the sustainability outcomes of organizations.

- A collaborative project between Dr. Bob Willard, The Natural Step Canada, B Lab, involving this researcher, has begun work which over time aims to develop a "Gold Standard for Sustainable Business" (See 7.7.7 and The Natural Step, 2013)

  This work includes ensuring that the elements of this proposed standard for strongly sustainable business is fully compatible with the SSBMO, its definitions and the associated business and ontology design principles.

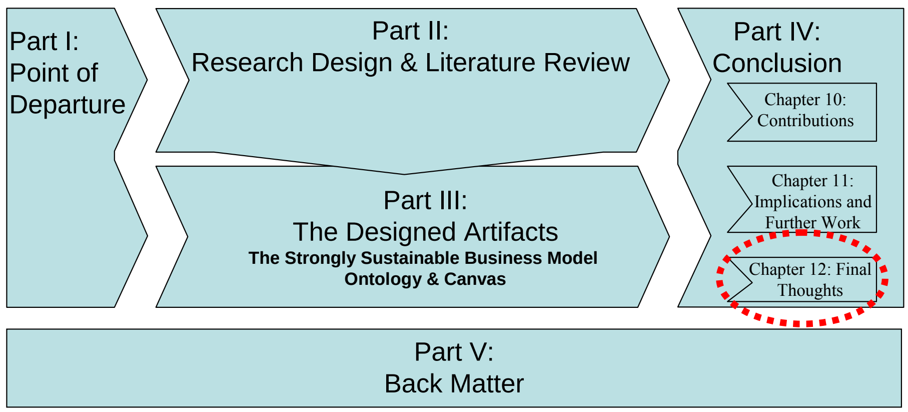
The results of all this work will form part of the crowd-funded collaborative action research project that will create the Strongly Sustainable Business Model Toolkit.

[23] (Upward, A. & Members Strongly Sustainable Business Model Group (SSBMG), 2012)

Chapter Twelve: Final Thoughts

Don't let a mad world tell you that success is anything other than a successful present moment…sense of quality in what you do, even the most simple actions — Eckhart Tolle

The future is already here – it's just unevenly distributed — William Gibson



At the conclusion of this research project, this chapter presents final thoughts, conclusions and lessons learned.

12.1 Results

As summarized in Chapter 8 (8.9-11), with some identified limitations, and significant opportunities for further research (Chapter 11), the designed artefact meets the research objective (RO) and enables the research question (RQ) to be answered in the affirmative.

As summarized in Chapter 10, the process of designing this research, the design of this research, and the results of the execution of the research design lead to significant contributions regarding:

- Understanding of the problem and solution spaces
- Theory of strongly sustainable organizations, their design, modelling and measurement
- Definitions of concepts related to strongly sustainable organizations, their design, modelling and measurement
- The practice of describing strongly sustainable business models
- The methods for designing and undertaking such research rigorously

12.2 Systemic Barriers and Challenges Uncovered

The intellectual barriers to designing and completing this work have been significant. The conceptual framework and key theoretical frames are far from mainstream in business and management academia today. The gap between the predominant neo-classical normal science of the majority of business school academia and the ecological / systems oriented, design science approach of this research is large.

As just one example: the explicit (let alone its rigorous) attempt of ensuring compatibility between the results of this micro-sociological and micro-economic research and the latest formal and natural science, marks this work as highly unusual.

One might argue that this research is on the leading or possibly even ‘bleeding’ edge of the knowledge frontier, pushing it well beyond what is expected or normal. As described in Chapter 1, my world-view, “where imagining such improved futures is the norm” and my "passion to understand how designing how things get done can realize those different futures" (1.1), was the driving force to bringing this work to competition.

One of the key personal learnings from this journey is that the flourishing of human and other life is an ethically sound and morally uplifting vision for an improved future.

That my committee was supportive in such an unusual inter- and perhaps even trans-disciplinary undertaking is highly appreciated.

Further, that others at the Ontario College of Art and Design and elsewhere align with the goals and the approach taken was also key: we need to make much faster progress at using existing knowledge to pro-actively design and evaluate improved futures if we are to avoid individually and collectively the worse effects of climate change and other anthropocentric challenges (Ehrenfeld, 2008).

Even if we (mistakenly) ignore the real context of business, a flourishing biosphere and human society, upon which its solvency ultimately depends, it is becoming increasingly apparent that best practices advocated by neo-classical research align with large portions of the findings of this research (Baskerville et al., 2009; Bullinger, 2008; Gharajedaghi, 2011; Holmström & Romme, 2011; Ing, 2011; March & Vogus, 2010; Martin, 2009; Melville, 2010; Osterwalder & Pigneur, 2011; Pourdehnad, Wexler, & Wilson, 2011a; Pourdehnad, Wexler, & Wilson, 2011b; Van Aken & Romme, 2009).

In short, irrespective of ones world-view it appears there is increasing consensus: we ignore this reality at our own peril. Returning to the opening quotations of this thesis:

> *We don't have to save the world. The world is big enough to look after itself. What we have to be concerned about is whether or not the world we live in will be capable of sustaining us in it* — Douglas Adams
>
> *Civilization exists by geological consent, subject to change without notice*
> — Will Durant
>
> *The one unchangeable certainty is that nothing is certain or unchangeable*
> —John F. Kennedy

12.3 Final Thoughts

For me, this has been an intellectually challenging and demanding journey. But through these challenges I have found it has been enjoyable to construct and execute a rigorous and high quality research design, creating and evaluating two innovative artefacts.

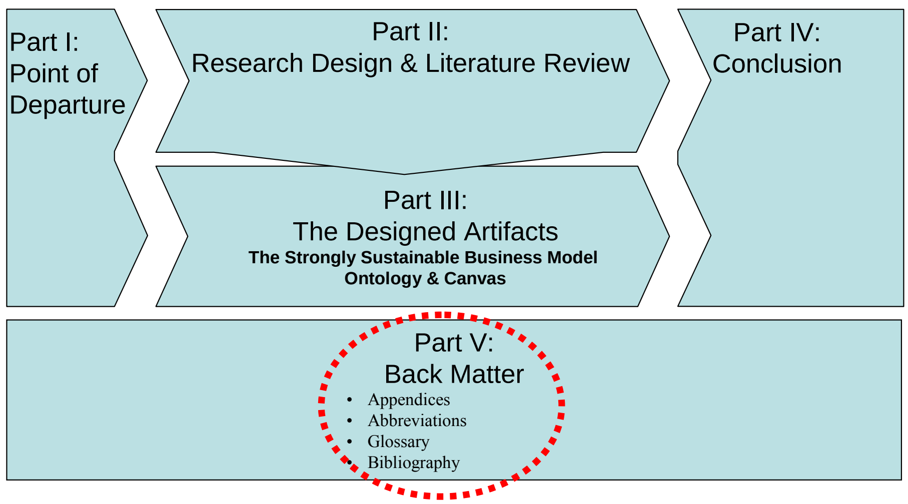
These are artefacts that have the potential of helping managers to avoid worsening, and at best start to help, in some small way, resolve the continuous critical problems described by the Global Problématique.

Our collective ability for each of us, and indeed for all life to flourish, now and in the future, depends on our ability to innovate in response to our new and changed circumstances. This is particularly true, as we enter fully into the anthroprocene, where these circumstances are largely shaped by the unintended consequences of our own individual and collective behaviour.

> *Its what you do next that counts* — Jamie Reagan, repeating advice from his Grandfather, from the TV Series "Blue Bloods"

Part V: Back Matter

Upon looking back from the end of the last chapter and surveying the texture of what has been wrote, it is necessary, that upon these following pages, a good quantity of heterogeneous matter be inserted, to keep up that just balance betwixt wisdom and folly, without which a book would not hold together a single year — Lawrence Sterne



A. Supplementary Materials

A list of the supplementary materials, available only in electronic form, is provided in the Front Matter of this thesis. A CD-ROM containing these files is enclosed with the bound copy of the thesis.

B. Appendices

B.1 List of Working Papers

Table B-1 lists the working papers were prepared during this work. Along with the researcher's logs, presentation materials describing the research method, artefacts and their construction, these working papers available upon request.

Label	Title and Description of Working Paper	Type
WP1	Strongly Sustainable Business Model Structure Design-v0.31 A working draft of Chapter 5 and 7	Document
WP2	Strongly Sustainable Business Model Canvas - Comparison to BMC-v0.3 As described in Chapter 5 and 7, the SSBMC was created from the SSBMO, which in turn is based on criticism and review of the BMO in light of the literature of strong sustainability (Chapter 4). This working paper provides summary comparison of SSBMC to the BMC for those already familiar with the BMC.	Document
WP3	Strongly Sustainable Business Model Ontology and Canvas Detailed Design Principles (DDP,CDP) v1.2 Summary of the key points of Chapter 3 and 4, including listing the RO, RQ, key definitions of a strongly sustainable business, value, value creation and destruction, the ontology Overall Design Principles (ODP1-2), the Detailed Design Principles (DDP1-5) and the Canvas Design Principles (CDP1-3).	Document and Presentation
WP4	SSBMO Stance on Sustainability Extract v1.1 Extract from drafts Chapter 3 and 4 of the review of the key theoretical frames related to the understanding of strong sustainability as it relates to organizations, i.e. it removes all methodological and research design related material.	Document
WP5	Strongly Sustainable Business Model Ontology - Comparison to BMO-v0.1 Extract from draft of Chapter 7 containing the detailed criticism and review of the BMO, leading to the identification of gaps, and the summary of the choices made to close those gaps in the SSBMO.	Document
WP6	Strongly Sustainable Business Model Ontology - Business Design Principles Extract v1.1 Extract consisting of drafts of Section 4.7.2 (Theory of the Conditions Required for Strongly Sustainable Organizations) and the Section 7.7 (Proto-Strongly Sustainable Business Design Principles)	Document
WP7	Strongly Sustainable Business Model Ontology - World-views Extract v1.0 Extract consisting of drafts of Section 4.5.3.3 (The Profit-First World-View of the Natural Sciences) and Section 4.6.3.3 (The Strongly-Sustainable World-View of the Natural Sciences).	Document
WP8	Summary of Future Research Agenda v1.0 Extract of draft of Chapter 11, Table 11-1, summarizing the future research agenda for the new field of Strongly Sustainable Business Models.	Document

Table B-1: List of Working Papers

B.2 Detailed Evaluation Activity Stream Materials

Specifically related to the evaluation activity stream the following detailed documentation is available upon request, subject to the confidentiality requirements agreed to during the informed consent process.

- Evaluation research logs
- Presentation materials describing the artefacts and their construction
- List of Reviewer Third Party Reviewer names (E2a)
- List of Case Study Company Respondents (E3)
- Data gathering instruments prepared and administered as part of the evaluation activity stream, including semi-structured interview questions (E2b, E3)
- Documents received from case study respondents (E3)
- Descriptions of the case firm's business model described using both a tabular form of the SSBMO (5.4.7, similar to SM6a) and post-it notes on the SSBMC (5.4.8, similar to SM7) (E3, K6-BM)
- Interview notes, recordings and associated transcripts for all 3rd party Evaluation Activities (E2, and E3)
- Nvivo qualitative analysis software database
- York University Human Participants Research Protocol and Risk Assessment Ethics Approval Certificate # STU 2011 - 103 (One for the period 2011-08-16-2012-08-16 and a renewal from 2012-08-13 to 2013-08-13)
- Human Participants Research Protocol and Risk Assessment Informed Consent Form

C. Abbreviations

The following abbreviations are used throughout this thesis.

AI	Artificial Intelligence
BM	Business Model
BMC	Business Model Canvas (Osterwalder, 2010, 2011)
BMO	Business Model Ontology (Osterwalder, 2004)
BOD	Board of Directors
BPx	Build principle
Cx	activity group within the Communication activity stream
CDPx	Canvas Design Principle
CRx	Candidate change to improve research Rigor
CUx	Candidate change to improve artefact Utility
D	Data concerning case firm
Dx	activity group within the build (Design) activity stream
DDPx	Detailed ontology Design Principle
E	Employee or Evaluation
Ex	activity group within the Evaluation activity stream (often followed by a specific evaluation activity group and individual activity, e.g. E2a-1a)
EHx	Evaluation Hypothesis
FEx	Further Epistemological research agenda item
FDx	Further Definitional research agenda item
GRx	Gap in research Rigor identified by evaluation activities
GUx	Gap in artefact Utility identified by evaluation activities
J	Justify (as one of the two key activities in descriptive science, along with Theorize)
K0	The Key theoretical frames, all the descriptive science truths input into the SSBMO. May also refer to only that portion of these truths that would be shared, i.e. agreed with, by those holding either the profit-first or strongly sustainable world-views.
K0-SS	Elements of the Key theoretical frames which describe truths that persons holding the Strongly Sustainable world view would agree with.
K0-PF	Elements of the Key theoretical frames which describe truths that persons holding the Profit-First world view would agree with.
K1-6	Element of comparator knowledge; when compared to the SSBMO enables metric values to be determined and hence an evaluation of utility to be made
Lx	designed Limitation

Mx	Evaluation Metric
MIS	Management Information Systems
NGO	Non-Governmental Organization (an organization with a net monetary profit of zero)
ODPx	Overall ontology Design Principle
OM	Operations Management
Px	activity group within the Preparation activity stream
PF	Profit First
pBDPx	proto Business Design Principle
Q-C	semi-structured evaluation activity interview item requesting feedback from a respondent at the Close of the interview.
Q-DGx	semi-structured evaluation activity interview item requesting DemoGraphic information from a respondent
Q-FI	semi-structured evaluation activity interview item requesting Feedback on an Instance of the SSBMO from a respondent
Q-FO	semi-structured evaluation activity interview item requesting Feedback on the strongly sustainable business model Ontology artefact (the SSBMO) from a respondent
Rx	identified Risk
ROx	Research Objective
RQx	Research Question
SDM	Soft Design Methodology
SS	Strongly Sustainable
SSBMC	Strongly Sustainable Business Model Canvas. An artifact created by this design science research project.
SSBMO	Strongly Sustainable Business Model Ontology. An artifact created by this design science research project
SMx	Supplementary Material
SSM	Soft Systems Methodology or Soft Systems Method
T	Theorize (as one of the two key activities in descriptive science, along with Justify)
TDP	Thesis communication Design Principle
THx	future research agenda item, suggested possible Testable Hypothesis
TSSOx	element of proto-Theory for the conditions for Strongly Sustainable Organizations
WHx	Working Hypothesis
WPx	Working Paper

D. Annotated Glossary

Backus-Naur Form (BNF)[1]

Backus-Naur Form is a notation for expressing the grammar of formal languages, such as that used to describe the relationships, cardinalities and possible values of the attributes of the entities which make up the capture and coding SSBMO (Chapter 7).

In this thesis, primarily Chapter 7, the following symbols are used to describe the relationships, cardinalities and possible values of the attributes of the entities of the entities which make up the capture and coding SSBMO.

=	The concept on the left is defined by the grammar on the right of the equals sign
{ }	Denote repetition of the enclosed symbols, zero, one or possibly more times
[ ]	Enclose optional items, i.e. the items either are included once, or are not included
|	Separates alternatives from which one should be chosen
“”	Encloses a literal string of characters which shall always appear
<>	Encloses a concept which needs to be made specific
..	Separates the start and end of a range of possibilities from which one must be selected, i.e. 0..9 or a..z
All characters	Abbreviation for a..b | A..B | 0..9 | <space>

[1] (Wikipedia Authors, 2013a)

Business Architecture

Business Architecture is the determination of an organization's design. Hence it is the business function which takes Business Strategy (the "direction" for a firm) and through a process of "design" and subsequent implementation creates the operations to "drive" the realization of the strategy. (Bodine & Hilty, 2009) *Business Architects Association (http://www.businessarchitectsassociation.org/*

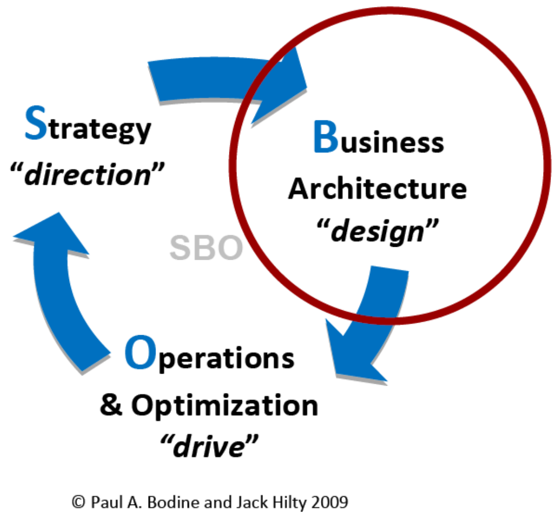


Figure D-1: The Place of Business Architecture Between Strategy and Operations
(Bodine & Hilty, 2009, p.6)

Mäkinen and Seppänen align with this perspective and suggest that the "business model concept could serve as an intermediate object of analysis between the resource configuration and strategy in venture creation. This provides the missing link between strategy and operations in exploiting entrepreneurial opportunities" (Mäkinen & Seppänen, 2007).

Versteeg & Bouwman in their 2006 article "Business architecture: A new paradigm to relate business strategy to ICT" state that business architecture is derived from the business strategy and forms a useful starting point to develop subsequent functional (i.e. operational) level architectures. (Versteeg & Bouwman, 2006).

Business Architect

"Business Architects design, obtain approval, translate and administer the implementation and ongoing improvement of the transformational business initiatives that enable organizations to convert strategy into commerce and prevail in the marketplace. Strategists are primarily concerned with the direction of the organization, Business Architects with the design of its dynamic structure, and line managers with driving results." (Bodine & Hilty, 2009, p.1)

The concept is supported and further detailed by Sauer and Willcocks, albeit referring to the role as an organization architect in their 2002 MIT Sloan Article "The Evolution of the Organizational Architect" (Sauer & Willcocks, 2002).

Business Model

"A Business model describes the rationale of how an organization creates, delivers, and captures value" (Osterwalder & Pigneur, 2009 p.14). See Alexander Osterwalder's 2004 PhD Thesis for a full explanation and historical context (Osterwalder, 2004).

Summarizing the purpose of a business model, and aligned with Osterwalder's perspective, Gilssman and Sanz state that a "business model is a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money" (Glissmann & Sanz, 2009, p.4).

Mäkinen, and Seppänen suggest that "business model concept could serve as an intermediate object of analysis between the resource configuration and strategy in venture creation. This provides the missing link between strategy and operations in exploiting entrepreneurial opportunities" (Mäkinen & Seppänen, 2007).

In this thesis a business model is defined as:

> A description of the rationale of an organization's existence: who it does it for, to and with, what it does now and in the future, how, where and with what does it do it, and how it determines and measures its success.
>
> or
>
> A description of how an organization can succeed over time

Operations

The people and function in a business who are responsible for "driving the organization's profitability" (Bodine & Hilty, 2009, p.6).

In the context of this thesis I take profitability to mean profit on all three dimensions of the "triple bottom line".

Pattern (Pattern Language, System Archetype)

Alexander states that "each pattern describes a problem that occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice" (Alexander, 1977).

This perspective is supported by two detailed articles by Falconer "The Business Pattern: a new tool for organizational knowledge capture and reuse" and "Business patterns as knowledge augmentation metaphor: the research frame of organizational change" (Falconer, 1999; Falconer, 2001). These articles provide a more complete description of the antecedents and challenges with the concept.

Finally, the idea that there are patterns that may be discerned in business models and that change over time is supported by a longitudinal survey of 50 business models conducted by Günzel & Wilker "Patterns in Business Models" in which they state there appear to be two forms of patterns "patterns of development and patterns of structure" (Günzel & Wilker, 2009). Also see a systems dynamics view of patterns see Braun (2002) and Meadows (1999).

Practice

"While process is clearly important to the overall coherence of an organization, in the end its is the practice of the people who work in the organization that brings process to life, and indeed, life to process. Organizations, then, should not attend to the process and process-related explanations only. They must also attend to practice. By practice, of course, we do not mean the sort of rote exercises people associate with phrases like *piano practice*. Rather we mean the activity involved in getting work done – the sort of activity that lies at the heart of medical practice or legal practice, [where] doctors and lawyers are practitioners of their [craft]." (Brown, 2000, pp.96-97)

(Gain) Privileged Access To

The terminology "gain privileged access to" is widely applicable across many of the relationships in the SSBMO. Hence a deeper explanation is required. Further this conception significantly changes the relationship of a firm to its resources and activities.

In the profit-first conception, a firm typically believes they have a significant amount of right to determine the disposition of resources which they own (or control) and how to undertake all activities over which they control. Legally of course it is possible to make an agreement for ownership rights over a resource or for a service (which contributes to an activity). These provide the owner some legal rights to control the disposition of the owned item or gain benefit arising from a service. In many cases these ownership rights are shared, e.g. when one actor has a 'financial interest in' it is assumed there is some degree of ownership involved, but that this is shared with other actors.

More recent ecological modernist inspired ideas of "stewardship over" start to consider other rights and responsibilities derived from ethical or moral imperatives, but these (as would be expected) are largely supplementary to the above concepts of legal / financial control and ownership.

Process (Organizational / Business)

"An organized group of related tasks that together create value" (Hammer, 1996)

Profit-First

In this thesis the world-views that leads to agreement with Milton Friedman, that monetary profit is the sole legitimate objective of firms, are labelled as "profit-first" (Friedman, 1962, p.133).

In this thesis:

> A "profit-first" organization is one in which monetary profit is the sole legitimate objective; success is defined in terms of attempting to maximizing monetary profit at all times and over time.

Strong Sustainability

Is this thesis strong sustainability is defined as:

- The possibility that human and other life will flourish on this planet forever" (Ehrenfeld, 2008, p.6).
- Paradoxically the result of "the interplay between a continuously evolving state of nature and a continuously changing state of mind" (i.e. based on human values which are always evolving), and not "a [static] ecological condition" (Allen, Tainter, & Hoekstra, 1999; Allen, 2003, p.23, p. 199 & p.381).
- Requiring active choices, not a passive consequence of doing less (p.12). The process of choosing must at a minimum answer "of what, for whom, for how long and at what cost" is the attempt at sustaining directed (p.26)

In this thesis:

A "strongly sustainable" organization is one in which all of its behaviours and all the behaviours of all other relevant social, economic and biophysical actors, lead to the possibility that human and other life will flourish on the planet forever.

Value chain

"Every firm is a collection of activities that are performed to design, produce, market, deliver and support its product. All these activities can be represented using a value chain. A firm's value chain and the way it performs individual activities are a reflection of its history, its strategy, its approach to implementing its strategy, and the underlying economics of the activities themselves." (Porter, 1985, pp.36-37)

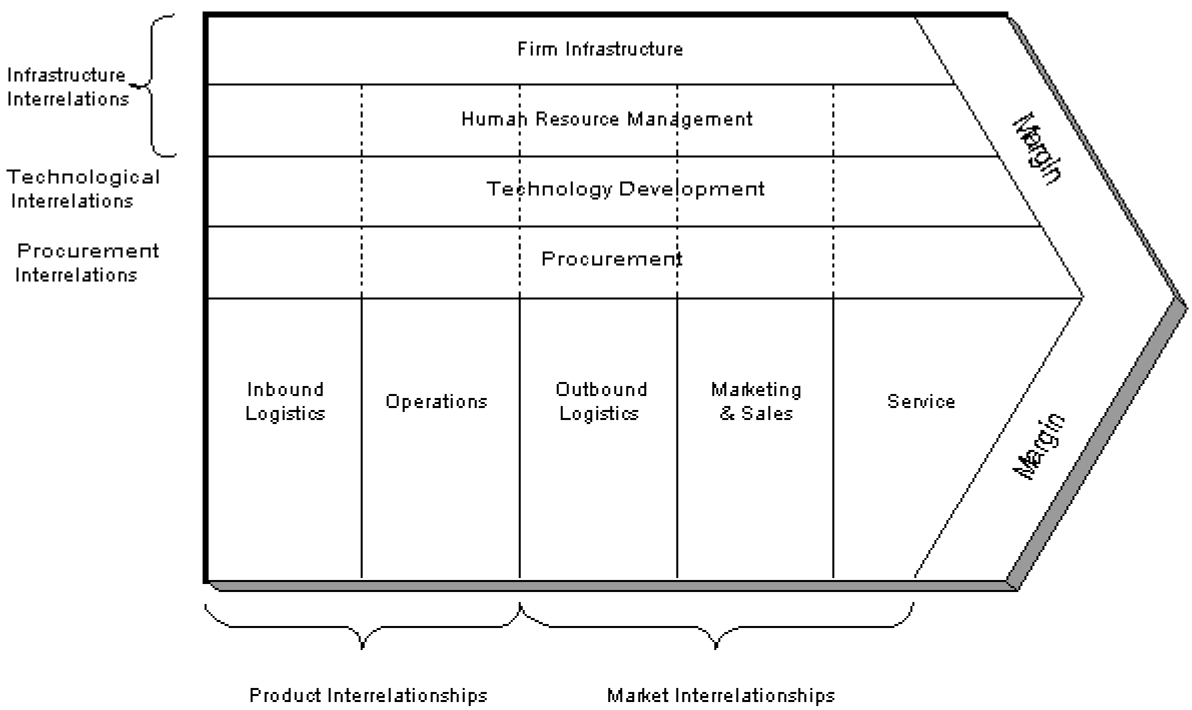


Figure D-2: Porters' Generic Value Chain of a Firm
(Porter, 1985, Fig.2-2 p.37)

Porter notes in a footnote that the value chain idea was based on the "business systems concept, developed by McKinsey and Company" which "captures the idea that a firm is a series of functions."

Hammer has suggested that it is the firm's business processes that form a firm's value chain (Hammer, 1996; Hammer, 1998a; Hammer, 1998b; Hammer & Stanton, 1999). Examples Hammer and practitioners provide of business processes that are at the value chain scale (so called "top-level business processes") include:

- Order to cash (i.e. the process which starts with the sales process, through the taking of the order, the making and delivering of the goods or services, the issuance of an invoice and which ends with the receipt of payment)
- Requisition to pay (i.e. the process which starts with the identification of a good or service required by the firm, through selecting a supplier, issuing a contract and/or purchase order, receiving the goods or services, storing the good or using the service, receiving an invoice from the supplier, and which ends with making payment to the supplier).

Value system (aka Business Network)

"A firms value chain is embedded in larger system of activities that I term the value system (Figure D-3). Suppliers have value chains (upstream value) that create and deliver the purchases inputs used in a firm's value chain. … A firm's product eventually becomes part of its buyer's value chain."(Porter, 1985, pp.34-35).

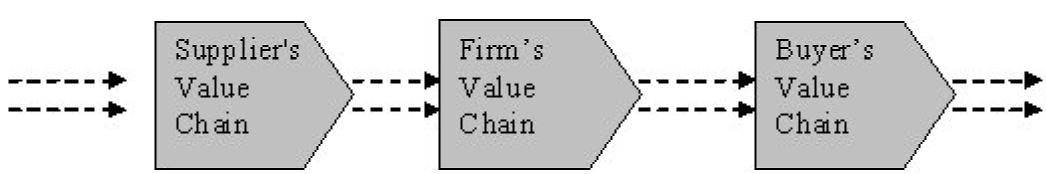


Figure D-3: Porters Generic Value System
(Simplified from Porter, 1985, Fig.2-1 p.35)

For a description of business networks, a more recent conception of value systems reflecting the impact of the internet on commerce, see (Tapscott, 2000).

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