A Socio-ecological Approach to Measure Progress for Ontario's Transition to a Green Economy: The Use of the Happy Planet Index

by

Jason Robinson

supervised by
Patricia Elaine Perkins

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Abstract

Government tends to look at economic growth and GDP as the primary measure of wellbeing in society. However, GDP does not consider many environmental impacts which have critical short and long-term economic effects. Due to this miscalculation about the concept of wellbeing, governments may downplay the ecological implications of growth and its contribution to inequality and poverty. Alternative measures to GDP exist to address the social and environmental aspects needed for a sustainable society. Alternative means are usually evaluated at the national level, but due to the Canadian political separation of powers and responsibilities, provincial governments have more responsibilities for environmental and social policy. This research paper explores the Happy Planet Index (HPI) in Ontario for over ten years, evaluating to what extent the Happy Planet Index addresses flaws in a GDP-based policy framework in Ontario. HPI is an eco-efficiency indicator which measures sustainable well-being, enabling policymakers to create effective policies towards the achievement of long, happy, and sustainable lives. HPI incorporates social and environmental variables which can be used by the provincial government in policy evaluation. The index includes three indicators: life satisfaction, a subjective measure of wellbeing that looks from the individual's perspective on how people rank their happiness and life satisfaction; health-adjusted life expectancy, the average number of years that an individual is expected to live in a healthy state, or the average lifetime someone is expected to live; and ecological footprint, which measures a person's consumption of nature.

Foreword

This major paper helped me to complete my plan of study by helping me expand my knowledge in the three components in my POS: public policy (a guide to action to formulated by the state to deal with public issues), ecosystem goods and services (the ecological characteristics, functions, or processes that directly or indirectly contribute to human well-being in a positive matter), and sustainable development (development that meets the needs of the present without compromising the ability of future generations to meet their own needs). Being able to combine all my knowledge in quantitative research and ecological economics I gained through the MES program helped me tremendously. Through this paper helped me dive deeper in topics I reference in my POS such as economic growth, systems thinking, ecosystems goods and service, and wellbeing in the perspective of Ontario.

My interest in researching alternative measures to progress stems from my interest in nonmonetary approaches to wellbeing in a social-economic-ecological system. As there has been more talk about the transition into a green economy, I felt that there was not much discussion about changing how to measure its progress. The focus remains on GDP, which has some play for a few issues in public policymaking.

This original research paper served to expand my knowledge on policy evaluation, subjective measures to wellbeing, data research methods to achieve my learning objectives in my POS directly focus on learning objective 1b (learn how to evaluate environmental policies), 1c (learn different types of data research techniques), 3a (learn alternative economic principles rather than conventional economics used), and 3c (learn how Ontario can successfully transition to a low carbon economy). For policy evaluation, I had gained knowledge of evaluation tools and methods beyond the curriculum offed in the program. I am learning about the different techniques used in the federal and provincial government to assess programs. Learning about how government around the world use subjective wellbeing as a form of policy evaluation and the use of the different techniques was an exciting read. Throughout this process, I was able to learn new software, R and SPSS, to conduct data analysis on my findings. Learning the two programs was a bit difficult but a great experience.

Introduction

Today climate change is getting more attention from government leaders and policymakers on its potential impact and cost. To address climate change, governments at the local, provincial/state and federal/national level are transforming their current economic systems which are fossil fuel-intensive to low carbon systems. A low carbon economy is an economic system based on little to no carbon emissions from different industries and sectors being emitted to the atmosphere (Institute for Competitiveness & Prosperity 2016). The transition to the low carbon economy will bring benefits ranging from economic activity to environmental sustainability. This economic system will stress on incorporating clean energy technologies and other sustainable action in countries. The current situation at the is global scale is most countries' current economic models rely on energy systems and other sectors that are fossil-fuel based.

In Canada, provinces and municipalities are shifting towards a green economy by developing renewable energy and energy efficiency systems developing sustainable transit and creating more access to greenspaces. This is done while emphasizing economic growth as the primary policy objective. Economic growth is the process by which a nation's wealth increases over time (Cornwall 2018). Economic growth has been the dominant form of measuring progress in society. Proponents of a low carbon economy need to emphasize more that sustainable development does not entail only economic growth; it includes improvements in the quality of life (education, housing, environmental protection, etc.) (Division for Sustainable Development 2011). With countries shifting away from fossil fuel-driven economies to improve citizens' lives, they are still tracing their progression through economic growth, which only views a state in a monetary lens while ignoring other elements.

Government tends to look at economic growth and GDP as the primary measure of wellbeing in society. But GDP does not consider many environmental impacts which have critical short and long-term economic effects. This miscalculation about the sources of prosperity ignores the environmental impacts of growth and its contribution to inequality and poverty. Individuals and governments treat the environment as an infinite source. With this thought process, they will tend to see the economy grow indefinitely as well. This thought process has led to adverse environmental and social outcomes. Many believe countries, mainly developed countries, should

focus on managing without economic growth. Since developed countries have stronger economies, they don't need to focus on economic growth. If a country shifts its focus to development instead of growth, it will lower the burden the economy has on the environment.

Alternative economic indicators exist to meet better the goal of measuring progress towards sustainable development. Typically, alternative measures of progress are calculated at the national level. For that reason, this paper discusses the need for provincial governments to incorporate an alternative means of progress to track qualitative improvement (development) and not just quantitative expansion (growth), to facilitate the successful transition to a low carbon economy. Alternative measures to should be explored more at the provincial level since the Canadian constitution distributed responsibilities of resource management, environmental and social policy to the provinces. Thus, I want to explore what extent an alternative measure of wellbeing addresses flaws in a GDP-based policymaking framework in Ontario. The indicator I will examine throughout this paper is the Happy Planet Index.

The alternative indicator I examine carefully in this paper is the Happy Planet Index. Throughout this paper, I provide details about the Happy Planet Index and its potential uses in Ontario. First, I overview background information about the Happy Planet Index. Second, I address the flaws GDP has in policymaking which the Happy Planet Index addresses. Third, I conduct data analysis to calculate Ontario's Happy Planet Index from 2005 to 2015. Lastly, I provide recommendations for policymakers to incorporate the Happy Planet Index and other alternative measures to GDP to assist in the transition to a green/low carbon economy.

Happy Planet Index

The Happy Planet Index (HPI) is an eco-efficiency indicator which measures sustainable well-being for all (New Economics Foundation, 2016). Eco-efficiency is the concept of resources efficiency (minimizing the resources used in producing a unit of output) and resource productivity (the effectiveness of economic activities in generating added value from the use of resources) (United Nations Economic and Social Commission for Asia and the Pacific 2009). Eco-efficient indicators are designed to capture the efficiency of societal activity in terms of consumption, production, and environmental impact. HPI allows us to see how well we are doing at achieving long and happy lives per unit of gha of natural resource consumption. The index identifies health

and a positive experience of life as universal human goals and recognizes that human systems depend upon ecosystem goods and services as primary inputs. It works as a tool to showcase the possibility of having a high standard of living without harming the earth through overconsumption of natural resources. The index incorporates two forms of sustainability assessment to identify approaches which maximize sustainability, socio-ecological system integrity, and resource maintenance and efficiency. Socio-ecological system integrity builds "human–ecological relations to establish and maintain the long-term integrity of socio-biophysical systems and protect the irreplaceable life support functions upon which human and environmental well-being depends" (Gibson 2006). Resource maintenance and efficiency provide a more extensive "base for ensuring sustainable livelihoods for all while reducing threats to the long-term integrity of socio-ecological systems by reducing extractive damage, avoiding waste, and cutting overall material and energy use per unit of benefit" (Gibson 2006).

The objective of the index to shift governments' perspective on achieving the goal of wellbeing for their citizens. Instead of a materialistic point of view, the government should follow Aristotle's perspective in which the highest achievement humans can obtain is happiness (Abdallah, Thompson, et al. 2009).

> "And of this nature Happiness is mostly thought to be, for this we choose always for its own sake, and never with a view to anything further: whereas honour, pleasure, intellect, in fact, every excellence we choose for their sakes, it is true (because we would choose each of these even if no result were to follow), but we choose them also with a view to happiness, conceiving that through their instrumentality we shall be happy: but no man chooses happiness with a view to them, nor in fact with a view to any other thing whatsoever… So, then Happiness is manifestly something final and self-sufficient, being the end of all things, which are and may be done" (Aristotle 2009, 8).

To achieve the maximum amount of happiness, ecosystems need to remain intact. They, directly and indirectly, contribute positively to human wellbeing and are essential for human survival, since they affect everyday life by supporting the economy, human health, and happiness (Fisher, Turner and Morling 2009). Ecosystem services include those for provisioning (food, freshwater, wood, fuel sources), regulating (water purification, disease regulation, climate regulation), supporting (nutrient cycling, primary production, soil formation), and cultural services (educational, recreational) (World Health Organization 2018).

HPI includes three components: life satisfaction, life expectancy, and ecological footprint. Life satisfaction is a form of subjective wellbeing which uses the perspective of an individual on how satisfied they are with their life through self-report. This indicator is used as an evaluative approach to capture their happiness and social and environmental quality surroundings. (Roberts, et al. 2015). Life Expectancy is the mean number of years a person is expected to live. The Ecological Footprint is a non-monetary accounting tool used to calculate specific environmental pressures with the consumption of goods and services by converting it to area units (O'Neill, et al. 2018).

The HPI showcases a more subjective form of wellbeing than an objective, which is typically used by governments. Objective wellbeing measures are conditions in society that are not dependent on an individual's perspective. Some of the dimensions used to measure objective wellbeing are income, house ownership, educational degree, number of people living in the house, location of residence (Ivković 2014). It is found that subjective wellbeing offers synergies with sustainable development and is a promising way of conceptualizing wellbeing since it considers a person's appreciation of different elements of life such as material consumption, health, social relationships, leisure and security (Davies 2014).

The importance of subjective wellbeing mentioned above leads to adjust life expectancy by incorporating a subjective measure with a health focus. Health-adjusted life expectancy (HALE) is the average number of years that an individual is expecting to live in a healthy state. While life expectancy measures the quantity of life, health-adjusted life expectancy measures the quality of life (Bushnik, Tjepkema and Martel 2018). It measures the problem of disease and injury, risk factors in the population, and the performance of public health efforts (Public Health Agency of Canada Steering Committee 2012). This adjustment is needed because life expectancy at birth in Canada has risen, but it does not tell how long a person has been healthy.

The Happy Planet Index is calculated with the following formula,

HPI = Happy Life Years/Ecological Footprint

Happy life years (HLY) is the combination of life satisfaction and health-adjusted life expectancy to estimate how much a population will live a long, happy, and healthy life. HLY is calculated using the following formula,

HLY = (Life satisfaction * Health-adjusted life expectancy)/10

This calculation will communicate how well Ontario over the years achieved sustainable wellbeing. This looks at interacting with social and ecological systems and how they are interdependent to one another. This approach the Ontario government needs to look closer to for their transition to a green economy since they interact between biophysical and social factors need to explore more in-depth by the government.

Methodology

This research consists of a quantitative data analysis of Ontario's HPI from 2005 to 2015. This will display any trends in the positive or negative effects of efficiency toward resource consumption and happiness over the years.

Life Satisfaction data was collected from the Canadian Community Health Survey (CCHS). CCHS is an annual survey program administered by Statistics Canada. This survey gathers information on Canadian citizens about different aspects of their health as well as collecting data on other socio-economic factors at the provincial level and health regions. The sample size of the surveys ranges from 50000 to 130000 people. The data is extracted from the Ontario Data Documentation, Extraction Service, and Infrastructure (ODESI). The datasets are available to subscribing institutions. Canadian universities have access to the data through the Data Liberation Initiative (DLI), which is a partnership between Statistics Canada and post-secondary schools to improve access to Statistics Canada data sources. Questions throughout the survey include the following questions: "how do you feel about your life as a whole right now", "how do you feel about your life as a whole", and "Using a scale of 1 to 10 where 1 means "Very dissatisfied" and 10 means "Very satisfied", how do you feel about your life as a whole right now?" From 2005-2010, the survey used a 1-10 scale for citizens to measure their life satisfaction. In 2010-2015 it used a 0-10 scale. To calculate the average life satisfaction of each year, a weighted mean was used. The weighted mean is the calculation of an average, but each data point does not contribute equally to the final mean.

The method to calculate HALE is the prevalence-based approach. This method uses period life tables and prevalence-based measures of disability and health status. Period life tables show the probability of someone's living to a certain age and the likelihood of surviving a specific year of age (Kagan 2018). The disability and health status data used is the Health Utilities Index (HUI). HUI is a rating scale which assigns values to different health status. The index was developed at McMaster University, which entails 30 years of research then it was adopted by the Health Utilities Inc., an organization based in Toronto (Horsman, et al. 2003). The index is appropriate for use to describe and monitor the health of general populations and has been extensively validated for use in cross-sectional and longitudinal population health studies (Statistics Canada 2012). The Canadian Community Health Survey program collects the data needed for the HUI. Data is gathered from questionnaires which ask participants about their everyday health status.

The questions do not ask about illness such as cold which can occur in a short period. The focus is on a person's natural healthy state. The rating is assessed using the Health Utilities Index Mark 3 (HUI3) method. HUI3 examines eight attributes: vision, hearing, speech, ambulation, dexterity, emotion, cognition, and pain or discomfort. Each attribute has either 5 (speech, emotion, and pain) or 6 (vision, hearing, ambulation, dexterity, and cognition) levels to measure. Level 1 means the individual has good health in that health state and dependent on the attribute level 5 and 6 means the person has terrible health in that attribute (Torrance and Feeny 1990). To determine where each response in the questionnaires falls at the attribute level, a multi-Attribute health status classification system is used to code the answers. Table 1 has details on each attribute level classification. The HUI score ranges from -0.36 to 1, where -0.36 means your in the worst possible state of health, 0 means you are dead, and 1 means perfect health. The multi-attribute coefficient is used to quantify their level for the equation. The following formula is used to determine the HUI score,

HUI = 1.731(Vision*Hearing*Speech*Ambulation*Dexterirty*Emotion*Cognition*Pain) – 0.371

Multi-Attribute Health Status Classification System: Health Utilities Index Mark 3 (HUI3)			
Attribute	**Level**	**Description**	**Multi-Attribute Coefficient**

Vision	1	Able to see well enough to read ordinary newsprint and recognize a friend on the other side of the street, without glasses or contact lenses.	1
	2	Able to see well enough to read ordinary newsprint and recognize a friend on the other side of the street, but with glasses.	0.98
	3	Able to read ordinary newsprint with or without glasses but unable to recognize a friend on the other side of the street, even with glasses.	0.89
	4	Able to recognize a friend on the other side of the street with or without glasses but unable to read ordinary newsprint, even with glasses.	0.84
	5	Unable to read ordinary newsprint and unable to recognize a friend on the other side of the street, even with glasses.	0.75
	6	Unable to see at all.	0.61
Hearing	1	Able to hear what is said in a group conversation with at least three other people, without a hearing aid.	1
	2	Able to hear what is said in a conversation with one other person in a quiet room without a hearing aid but requires a hearing aid to hear what is said in a group conversation with at least three other people.	0.95
	3	Able to hear what is said in a conversation with one other person in a quiet room with a hearing aid, and able to hear what is said in a group conversation with at least three other people, with a hearing aid.	0.89
	4	Able to hear what is said in a conversation with one other person in a quiet room, without a hearing aid, but unable to hear what is said in a group conversation with at least three other people even with a hearing aid.	0.8
	5	Able to hear what is said in a conversation with one other person in a quiet room with a hearing aid, but unable to hear what is said in a group conversation with at least three other people even with a hearing aid.	0.74
	6	Unable to hear at all.	0.61
Speech	1	Able to be understood completely when speaking with strangers or friends.	1
	2	Able to be understood partially when speaking with strangers but able to be understood completely when speaking with people who know me well.	0.94
	3	Able to be understood partially when speaking with strangers or people who know me well.	0.89
	4	Unable to be understood when speaking with strangers but able to be understood partially by people who know me well.	0.81

	5	Unable to be understood when speaking to other people (or unable to speak at all).	0.68
Ambulation	1	Able to walk around the neighborhood without difficulty and without walking equipment.	1
	2	Able to walk around the neighborhood with difficulty, but does not require walking equipment or the help of another person.	0.93
	3	Able to walk around the neighborhood with walking equipment, but without the help of another person.	0.86
	4	Able to walk only short distances with walking equipment and requires a wheelchair to get around the neighborhood.	0.73
	5	Unable to walk alone, even with walking equipment. Able to walk short distances with the help of another person and requires a wheelchair to get around the neighborhood.	0.65
	6	Cannot walk at all.	0.58
Dexterity	1	Full use of two hands and ten fingers.	1
	2	Limitations in the use of hands or fingers but do not require special tools or help of another person.	0.95
	3	Limitations in the use of hands or fingers are independent with the use of special tools (does not require the help of another person).	0.88
	4	Limitations in the use of hands or fingers requires the help of another person for some tasks (not independent even with the use of special tools).	0.76
	5	Limitations in the use of hands or fingers, requires the help of another person for most tasks (not independent even with the use of special tools).	0.65
	6	Limitations in the use of hands or fingers, requires the help of another person for all tasks (not independent even with use of special tools).	0.56
Emotion	1	Happy and interested in life.	1
	2	Somewhat happy.	0.95
	3	Somewhat unhappy.	0.85
	4	Very unhappy.	0.64
	5	So unhappy that life is not worthwhile.	0.46
Cognition	1	Able to remember most things, think clearly, and solve day to day problems.	1
	2	Able to remember most things but have a little difficulty when trying to think and solve day to day problems.	0.92
	3	Somewhat forgetful, but able to think clearly and solve day to day problems.	0.95
	4	Somewhat forgetful and have a little difficulty when trying to think or solve day to day problems.	0.83

	5	Very forgetful and have great difficulty when trying to think or solve day to day problems.	0.6
	6	Unable to remember anything at all, and unable to think or solve day to day problems.	0.42
Pain	1	Free of pain and discomfort.	1
	2	Mild to moderate pain that prevents no activities.	0.96
	3	Moderate pain that prevents a few activities.	0.9
	4	Moderate to severe pain that prevents some activities.	0.77
	5	Severe pain that prevents most activities.	0.55

Table 1 Source: The Health Utilities Inc. website (Health Utilities Inc 2018).

I used the following steps to calculate the Health-adjusted life expectancy at birth for Ontario citizens:

1. Obtain the number of life-years lived between age x and x+1 and number of survivors at age x from life tables data on Statistics Canada website
2. Obtain the HUI3 ratings from the Canadian Community Health Survey database
3. Grouped ages (under 14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, and over 75)
4. Find the total number of life-years lived for each age group
5. Find the average HUI score for each age group
6. Adjust the life years lived variables for each age group with HUI3 rating of that same age group
7. Add all health-adjusted life years lived by age groups, then divide by the number of survivors at age 0 (100000)

The following formula below is used for this process.

$$HALEx = \frac{\sum_{i=x}^{w}(Li * Wi)}{\text{Lx}}$$

Where:
HALE is health-adjusted life expectancy;
x is the age for health adjusted-life expectancy is to be estimated;
i is an index representing the lower limit (x) of the age interval;
L_i is the number of life-years lived in the age group;
H_i is a score or weight representing the average level of health-related quality of life for the age group; and
w is the total number of age groups in the life table.
So now you've got HHLY; the next section focuses on EF.

The ecological footprint measures the extent of ecological demands to maintain human economic systems have on earth biological supply. Ecological footprints are calculated based on six sub footprint categories of productive surface areas: cropland, grazing land, fishing grounds, built-up land, forest area, and carbon demand on land. It is measured in global hectares/capita. Ecological footprint data is obtained through the top-down method. This method uses Canada's

ecological footprint and scales it up or down based on consumption difference. This is achieved through economic data and household spending (Moore, et al. 2013). To begin the process, using the data from the Survey of Household Spending I categorized each consumption expenditure under 5 household consumption categories, defined by the United Nations Classification of Individual Consumption According to Purpose (COICOP), which are food, transportation, shelter, goods, and services (Department of Economic and Social Affairs 2018). Next, household expenditures for each category were expressed per capita to be alike Canada's ecological footprint since it is given as gha per capita [Equation 1]. After, I calculated the scaling factor for each category. Scaling factor helps to determine based on household spending and the consumer price index if Ontarians consume x amount in each consumption category than the average Canadian. This is done first by dividing the expenditure/capita of consumption category in Ontario with expenditure/capita of same consumption category in Canada. Then you divide consumer price index (CPI) of consumption category in Ontario with the consumer price index of the same consumption category in Canada. You then divide the result from the expenditure/capita with cpi to get the scaling factor [Equation 2]. Last, I calculated Ontario's ecological footprint multiply each sub footprint by the scaling factor, then adding them up together [Equation 3]. For the carbon footprint, an energy factor must be computed with it as well with the scaling factor [Equation 4 and 5]. Energy factor is used to estimate the carbon footprint connected to electricity, gas, and other fuels. Its calculation is based on the CO_2 intensity of Ontario divided by the CO_2 intensity of Canada, which represents the amount of GHGs per unit of GDP (Isman, et al. 2018). Using the average household expenditure data from the Survey of Household Spending and the relative Consumer Price Index for Canada and Ontario. The following steps were used to calculate the ecological footprint.

Equation 1: Expenditure/capita = Expenditure/Average Household size

Equation 2: $SF= (Expenditure_{ONx} /Expenditure_{CANx})/(CPI_{ONx} /CPI_{CANx})'$

Where,
SF is a scaling factor;
$Expenditure_{ONx}$ is the average household expenditure of consumption item x in Ontario;
$Expenditure_{CANx}$ is the average household expenditure of consumption item x in Canada;
x is the consumption category;
CPI_{ONx} is the Consumer Price Index of consumption category in Ontario; and
CPI_{CANx} is the Consumer Price Index of consumption category in Canada

Equation 3: $EF_{ON} = (CF_{can} * SF * EnF) + (CrF_{can} * SF) + (FF_{can} * SF) + (GF_{can} * SF) + (FgF_{can} * SF) + (BlF_{can} * SF)$

Where,
CF_{can} is Canada's Carbon Footprint,
EnF is the energy factor
CrF_{ca} is Canada's Cropland Footprint;
FF_{can} is Canada's Forest product footprint;
GF_{can} is Canada's Grazing Footprint;
FgF_{can} is Canada's Fishing Ground Footprint; and
BlF_{can} is Canada's Built-up land Footprint

Equation 4: $EnF = (CO_2\ Intensity_{ON} / CO_2\ Intensity_{CAN})$

Equation 5: CO_2 Intensity = CO_2 emission/GDP

HPI Addressing the Flaws of GDP in Policymaking

Measuring progress has an impact on influencing government and individuals on prioritizing what needs to be addressed. GDP has a stronghold on government since it has so much public awareness that politicians must maintain high GDP no matter the cost. The HPI represents a paradigm shift away from GDP and goes back to the primary form of economics which is what we put in (natural capital) the means produce from it (human economics systems) and the product (sustainable wellbeing, happiness, and longevity). Life satisfaction, health-adjusted life expectancy, and ecological footprint are indicators in the HPI that help to measure socio-economic development and human prosperity. Right now, jurisdictions, such as Ontario, run more on quantitative change (economic growth), but they should shift its focus on qualitative change (sustainable development) (Victor 2008).

Subjective Wellbeing as a Measure of Policy Evaluation

GDP is an indicator that tends to be used as a form of policy evaluation. Unlike GDP, which defines wellbeing in a narrow financial perspective in terms of wealth and income, HPI's non-monetary approach to measure wellbeing uses more of a broad definition, looking at welfare from several approaches.

> "A positive physical, social, and mental state; it is not just the absence of pain, discomfort, and incapacity. It requires that basic needs are met, that individuals have a sense of purpose and that they feel able to achieve

> important personal goals and participate in society. It is enhanced by conditions that include supportive personal relationships, strong and inclusive communities, good health, financial and personal security, rewarding employment, and a healthy and attractive environment" (Roberts, et al. 2015, 15).

This form of wellbeing investigates the diversity of experience as it draws out matters that affect on person's quality of life. But, the use of life satisfaction and happiness data as a tool for policy evaluation has been debated among researchers in various fields. Economist Joseph Stiglitz, in his report for the Organisation for Economic Co-operation and Development (OCED), defended this approach to measure wellbeing as it is valid as objective measures of wellbeing.

> "Research has shown that it is possible to collect meaningful and reliable data on subjective as well as objective well-being. Subjective well-being encompasses different aspects (cognitive evaluations of one's life, happiness, satisfaction, positive emotions such as joy and pride, and negative emotions such as pain and worry): each of them should be measured separately to derive a more comprehensive appreciation of people's lives...SWB should be included in larger-scale surveys undertaken by official statistical offices" (Stiglitz, Sen and Fitoussi 2009, 16).

Environmental Consequences

Since economic growth as the top priority for policymakers, it ignores the penalties it has on the environment. GDP does not consider natural resource depletion and other environmental factors, but expenditures spent on natural disasters are a positive contribution to GDP. The issue is that the government ignores or unaware that economic and environmental systems are interdependent to one another since human systems are embedded within a biological sphere. This is rooted in ecosystem goods and service, which has characteristics, functions, and processes that directly or indirectly contribute to human wellbeing in a positive manner (Fisher, Turner and Morling 2009). Ecosystem goods and services are essential for human survival since they affect our everyday life and underpin the economy, human health, and happiness. If this is ignored it will create negative side effect on our lives since ecosystems are responsible for provisioning (food, freshwater, wood, fuel sources), regulating (water purification, disease regulation, climate regulation), supporting (nutrient cycling, primary production, soil formation), and cultural (educational, recreational) (World Health Organization 2018). The importance of ecosystem

goods and services is disregarded in the mainstream school of economic thought since the environment is viewed as an externality to the economy, and if an economy is well-managed, it can grow indefinitely. As well the loss of benefits in natural capital is fine as long it goes towards goods that benefit society such as built and financial capital to grow the economy. The HPI incorporates ecological footprint as an essential indicator in since if a community producing a high standard of living for its citizens, but at the cost of the environment through extensive resource extraction which may cost future generations the same opportunity is not prosperous society.

Making Distinctions Between Positive and Negative Number

Every component of GDP is counted as a positive number. GDP does not make the distinction between welfare-enhancing activities that increase wealth and welfare-reducing activities such as defense spending, crime-related costs, and insurance. Welfare-reducing actions do not amount to increases in net wellbeing since they are used more to prevent problems or fix negative social and environmental impacts (Giannetti, et al. 2014). The HPI has a specific positive and negative component to it. The positive indicator being the happy life years with life satisfaction and life expectancy and the negative component being the ecological footprint. Life satisfaction and life expectancy articulate an aspect of life that needs to maintain and keep on growing, and ecological footprint represents action needed to reduce consumption to meet future needs.

Since GDP puts everything together as a positive number, it disregards social and economic inequalities. Typically, the government uses GDP indicator of increase of wealth for all. For example, GDP per capita measures economic output that accounts for the countries population by dividing GDP with the population. This should indicate prosperity and high standard of living in a state. The assumption is that when GDP per capita rises, so does income. But GDP per capita does not tell us the distribution of wealth. The rise in GDP per capita may result in a surge in wealth for a few individuals but remain the same or decrease for others. Ontario is shown to have one of the highest income inequalities among the provinces between 1982 and 2014, but this is ignored in GDP (Fong 2017). Another issue is that GDP does not look at the effects of unemployment, which can have effects on someone's standard of living. HPI does not directly measure income inequality or unemployment, but it has been shown that that subjective wellbeing

is correlated to them. In Peter Victor's Managing Without Growth, book, discuss the topic of happiness and looks at the difference between changes in happiness with income and unemployment in a country. Canadians reported a 0.4 increase on 0-10 scale on reported happiness between 1946 to 1998 at the same time; real incomes rose 150 percent (Victor 2008). When it came to unemployment, there was a difference with change. He finds that when unemployment rises to 1 percent, it results in a reduction in happiness, similar to an 8.6 percent drop in real income (Victor 2008).

Now that I explain how the Happy Planet Index is better suited to address some of the social and ecological issues GDP overlooks, the next section investigates applying the HPI in Ontario.

Ontario's Happy Planet Index

This section will look at the data results of calculating the HPI for Ontario from 2005 to 2015. It will provide information on the process of collecting the data needed for the calculation as well the results of the HPI and indicators for it, and an explanation of why these results occur.

The process of collecting the data for the HPI was complicated at times, mainly the ecological footprint since it required to go to several sources and calculate every household consumption to determine the ecological footprint. This process brings up an issue with data accessibility. Much of the data needed for this research was available for post-secondary institutions through the data liberation program and subscribing institutions. For other individuals, this data will be hard to find without access to this database.

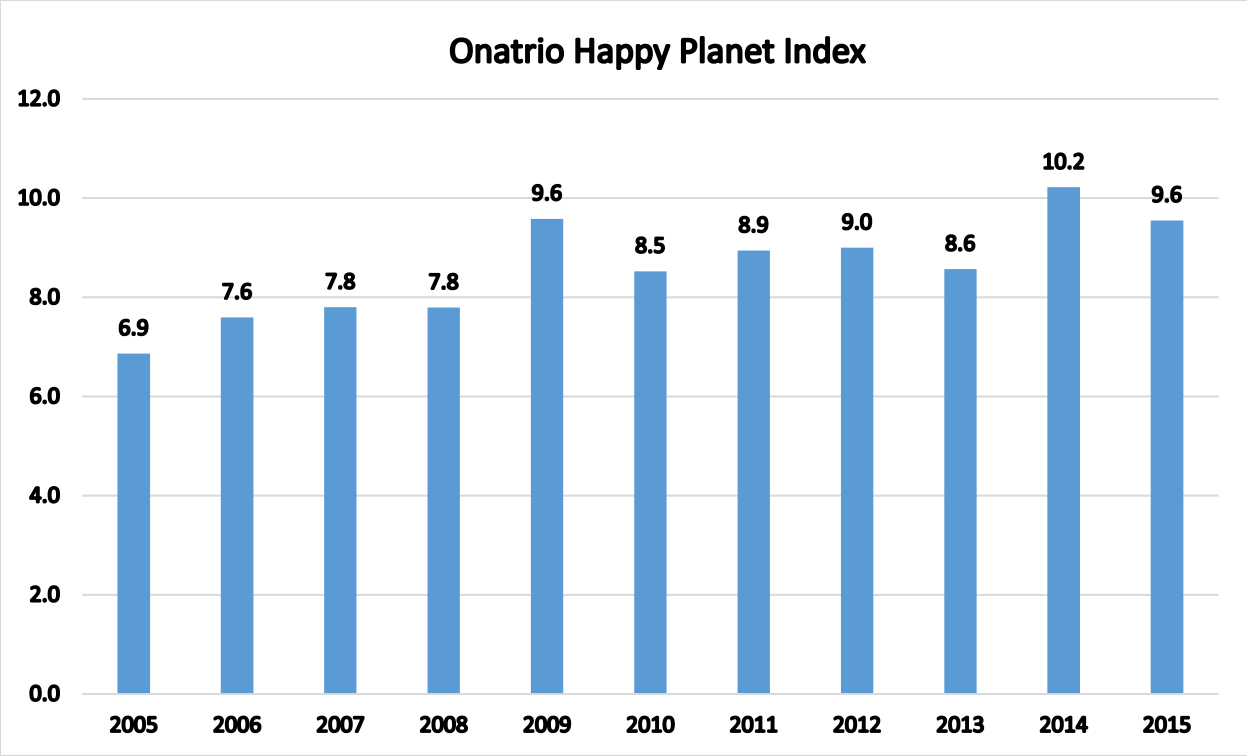
Table 1 below shows the results of Ontario's happy life years, ecological footprint, and HPI between 2005-2015. The Happy life years data came from obtaining health unities index scores and life satisfaction rating from the Canadian Community Health Survey and then going to Statistics Canada to gather the life tables to calculate the health-adjusted life expectancy. Next, I computed life satisfaction and health-adjusted life expectancy to find the product which is Happy life years. Ecological footprint data was acquired through the Survey of Household Spending found on ODESI to and the consumer price index on Statistics Canada to reveal the average amount of household consumption expenditure for five consumption categories. Canada's ecological

footprint was also gathered from the Global Footprint Network for the scaling process to determine Ontario's ecological footprint.

Ontario HPI			
Year	Happy Life Years	Ecological Footprint (gha)	HPI (Happy Life Years/gha
2005	52.9	7.71	6.9
2006	54.8	7.22	7.6
2007	55.8	7.15	7.8
2008	55.1	7.07	7.8
2009	57.8	6.03	9.6
2010	52.9	6.21	8.5
2011	56.9	6.36	8.9
2012	56.0	6.22	9.0
2013	56.6	6.61	8.6
2014	59.4	5.81	10.2
2015	53.7	5.62	9.6

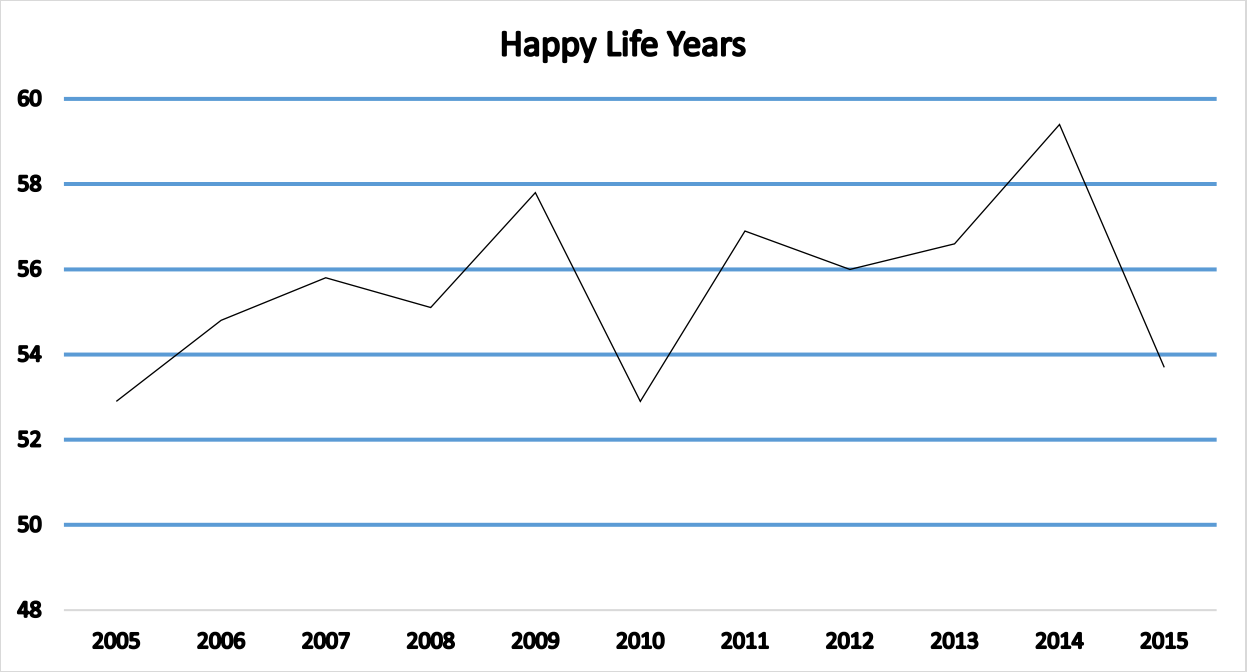
Table 2 Ontario Ecological Footprint, Happy Life Years, and Happy Planet Index (Statistics Canada 2019), (Global Footprint Network 2019), (Statistics Canada 2005-2015)

In the ten years, Ontario managed to produce a range of 6.9 to 10.2 happy life years per unit of gha, as shown in Graph 1. In the ten years, Ontario is not close to the highest amount HPI to obtain which 49.1 happy life years/gha. This based this is based on the threshold set out by the New Economics Foundation. The thresholds for the three indicators are a 10 for life satisfaction to represent a perfect rating, 87 years for life expectancy (since this research uses health-adjusted life expectancy, the health utility index score must be a 1 to indicate perfect health for life expectancy to remain 85 years), and ecological footprint being at 1.78 gha (Abdallah, Michaelson, et al. 2012, 21). A factor that plays into Ontario having a low HPI is the ecological footprint. Even though they have not to reach sustainable wellbeing yet, it has been showing over the years that their ecological footprint is decreasing. This is due to several policies passed by the government since 2003. The ecological footprint section will go more in detail on this.



Graph 1 Ontario's Happy Planet Index (Global Footprint Network 2019), (Statistics Canada 2019), (Statistics Canada 2005-2015)

In 2009 and 2014 shows a spike increase of HPI. This happens because of a substantial decrease in the ecological footprint by 15 percent in 2009 and 12 percent in 2014, resulting in a rise in HPI by 23 percent in 2009 and 19 percent in 2014. The 2009 HPI surprised me the most because it was during the Great Recession. The Bank of Canada announced the Canadian economy would enter a recession starting December 2008 (The Canadian Press 2008). The recession ended in July 2009, but the economic recovery period began in late 2009, and it will not fully recover till 2010 (Trichur 2009). It made sense during this time ecological footprint went down since it was calculated based on household consumption and usually around an economic crisis; people spend less on goods and services. According to the Survey of Household Spending from 2008 to 2009, this had occurred. But the result I didn't expect was the life satisfaction to increase as well. It went up from 7.87 in 2008 to 8.23 in 2009. In 2009 the unemployment rate for Ontario increase to 9.1 percent (Newfoundland & Labrador Statistics Agency 2017). From several kinds of literature, it usually shows that when unemployment is high, life satisfaction decreases. This occurred in 2010 when the unemployment rate decrease to 8.7 percent and life satisfaction dropped 9 percent to 7.53 (Statistics Canada 2005-2015), which can be seen on the happy life years graph below. The drop may be as a result in the economy not recovering till late 2010.

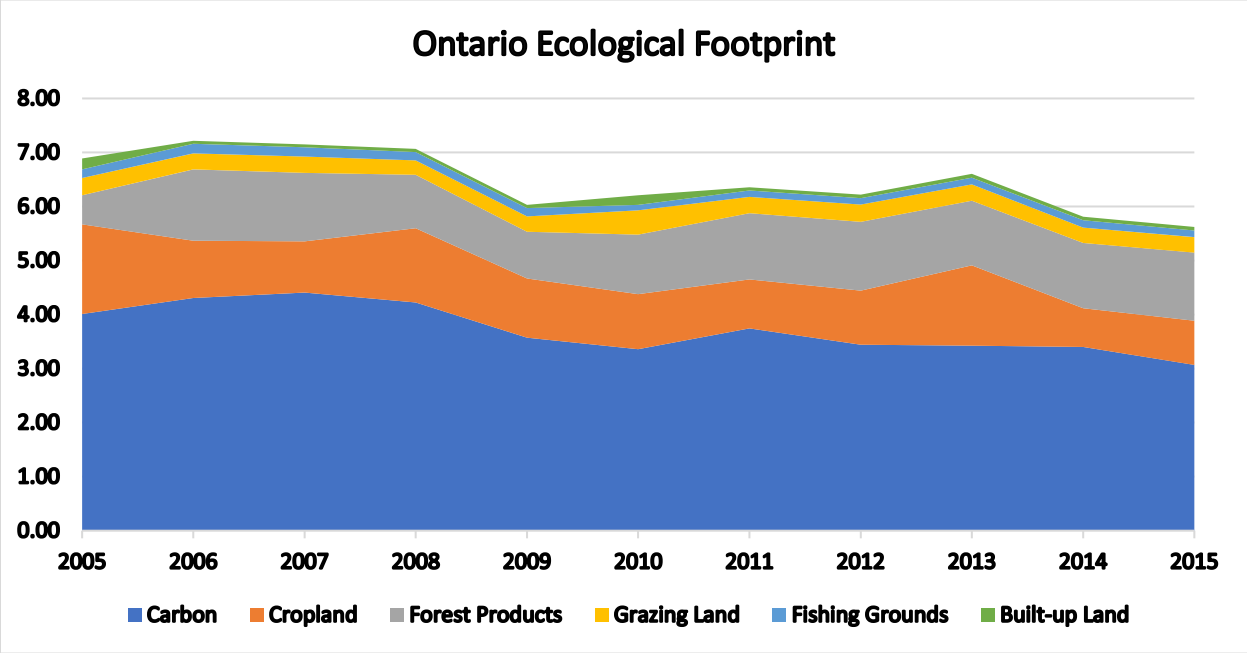


Graph 2 Ontario Happy Life Years (Statistics Canada 2012), (Statistics Canada 2005-2015)

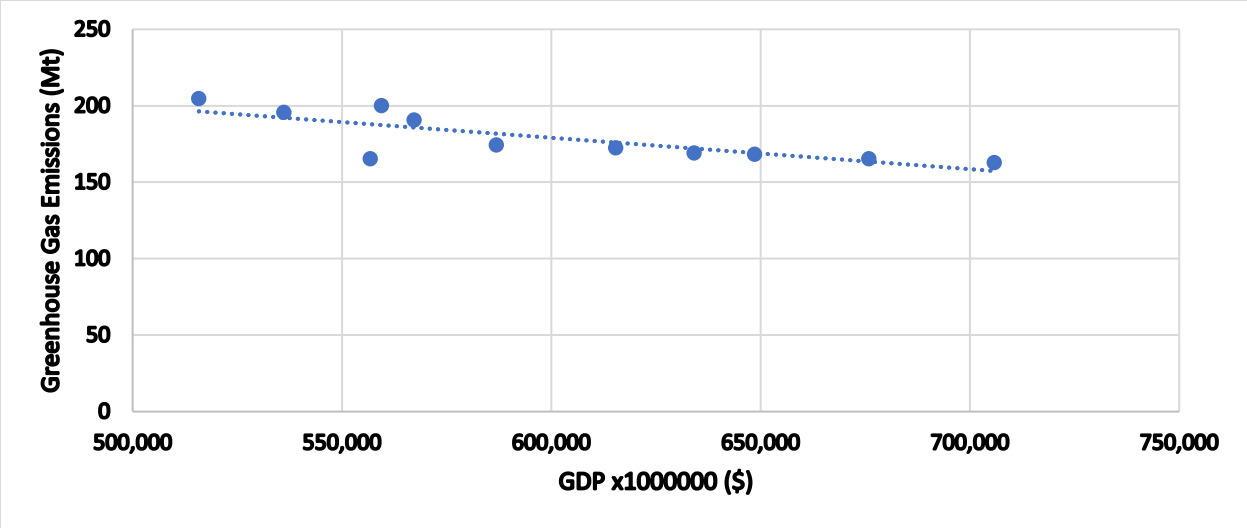
Ecological Footprint

The most significant contributing factor to Ontario's ecological footprint is the carbon footprint. The carbon footprint makes up on average 57 percent in Ontario in the ten years (Graph 3). The decrease in Ontario's carbon footprint compared to Canada may be contributed to its dedication in transition the province to a low carbon/green economy. A significant factor that helped with early on was Ontario's commitment to phase out of coal from electricity generation. The phase-out started in the early 2000s till 2014. Coal went from producing 25 percent of Ontario's electricity supply in 2003 to 0 percent in 2014 (Ministry of Energy, Northern Development, and Mines 2017). This was the equivalent of removing 7 million cars off the road (Cundif 2015). This phase-out made Ontario the first government in North America to completely rid of coal-fired power from its energy supply (Harris, Beck and Gerasimchuk 2015). The coal phase-out had significant pushback from several organizations. The Association of Major Power Consumers in Ontario (AMPCO) believed that the cut in coal would lead to a loss of $16 billion on the Ontario's GDP (Harris, Beck and Gerasimchuk 2015). The removal of coal didn't harm GDP since it increased at 3 to 5 percent each year (Statistics Canada). The only year GDP decrease was 2009 because of the recession. Graph 4 displays how Ontario's has managed to increase it's GDP while at the same time decrease it greenhouse gas emissions while all of Canada has not been

able to do so as it has the opposite effect. Ontario reducing their CO2 emissions and increasing GDP can be contributed to its investment in renewable energy jobs, and energy efficiency programs for households and businesses. The chart displays that Ontario is moving towards a decoupling stage. Decoupling occurs when economic growth arises without an outward increase in environmental cost or demands (Division for Sustainable Development 2011). More specifically, this form of decoupling is impact decoupling. Impact decoupling requires increasing economic production while reducing negative environmental impacts from as extraction of resources, manufacturing, transportation, and waste. Ontario is decoupling its economy to mitigate adverse ecological impacts while adding value in economic terms.



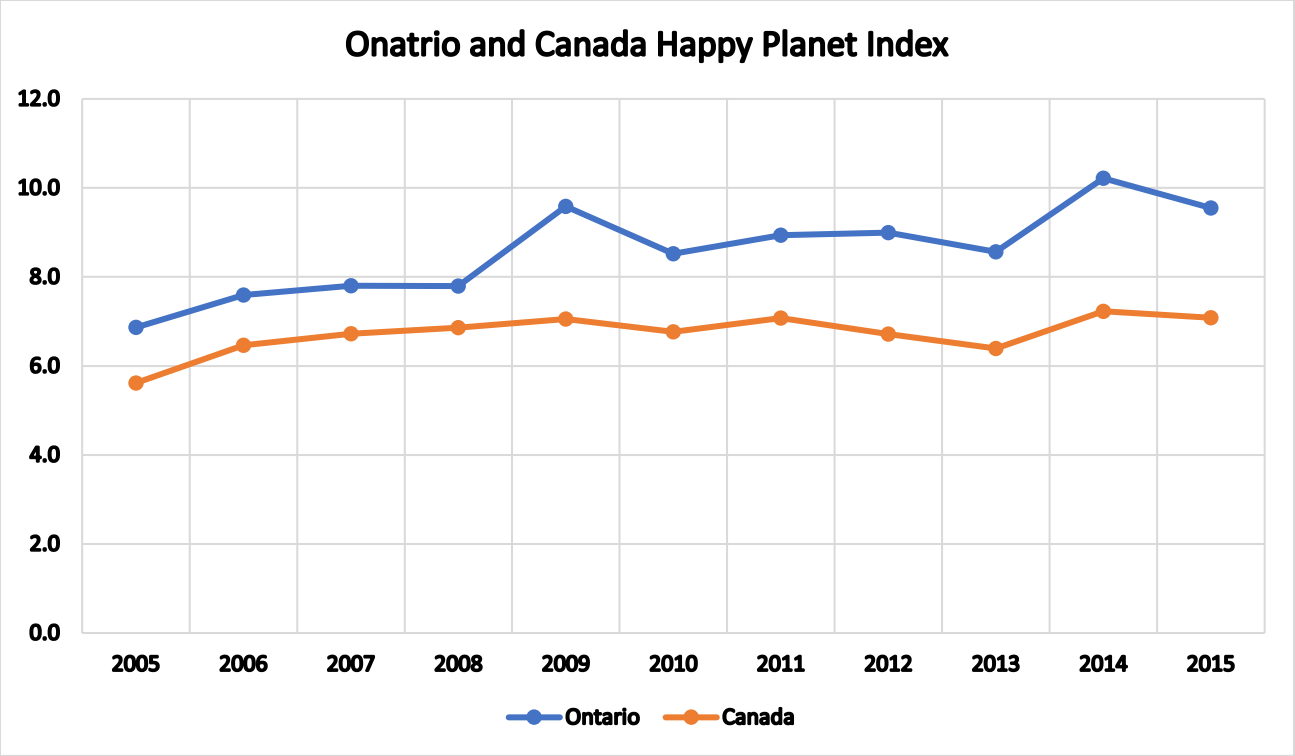
Graph 3 Ontario's Ecological Footprint (Global Footprint Network 2019), (Statistics Canada 2019)



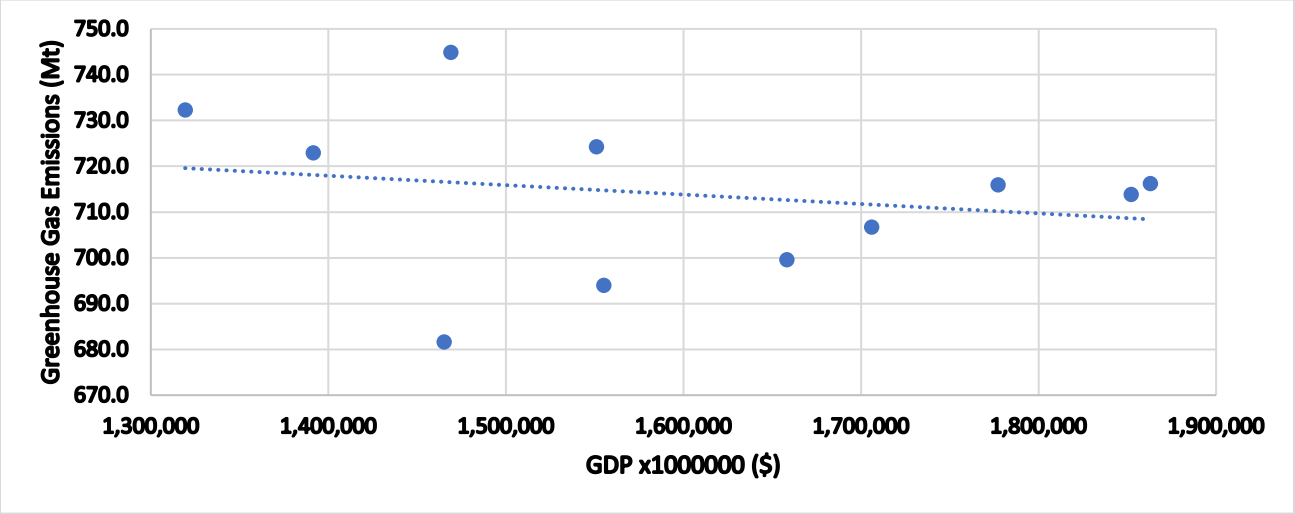
Graph 4 Ontario's environmental efficiency (Environment and Climate Change Canada 2019), (Statistics Canada 2019)

Comparing Ontario and Canada HPI

This section looks at how Ontario did with the rest of Canada since the HPI has usually been applied in Canada as a whole. Graph 5 below compares Ontario and Canada HPI. In all the ten years, Ontario had a higher HPI than Canada. The contributing factor for this outcome is the ecological footprint since Canada's overall ecological footprint is more extensive than Ontario's. This is the result of the federal government not having much of direct say how provinces use their natural resources since it not jurisdictional power when it comes to the environment on provincial land stated in the constitution. Since the federal government has no say in provinces using their natural resources, some of the provincial government believe in having economic growth; they need to run more of a resource-based economy. For example, a province for decades that run more of a resource-based economy and most certainly the most significant contributor to Canada's high ecological footprint in Alberta. Northern Alberta contains the third-largest oil reserves in the world in the oils sands. The oil sands take up 142200 km² with an estimated 165.4 billion barrels of oil in its reserves and producing around 2.8 million barrels per day in 2017 (Alberta Energy 2019). This may be a factor in why Canada's carbon footprint on average was 67 percent. Graph 6 below shows that an increase in Canada's GDP most likely results in a rise in CO_2 emissions.



Graph 5 Comparing Ontario and Canada Happy Planet Index results (Statistics Canada 2012), (Global Footprint Network 2019), (Statistics Canada 2005-2015)



Graph 6 Canada's environmental efficiency (Statistics Canada 2019), (Environment and Climate Change Canada 2019)

Ontario's HPI Ranking with other Countries

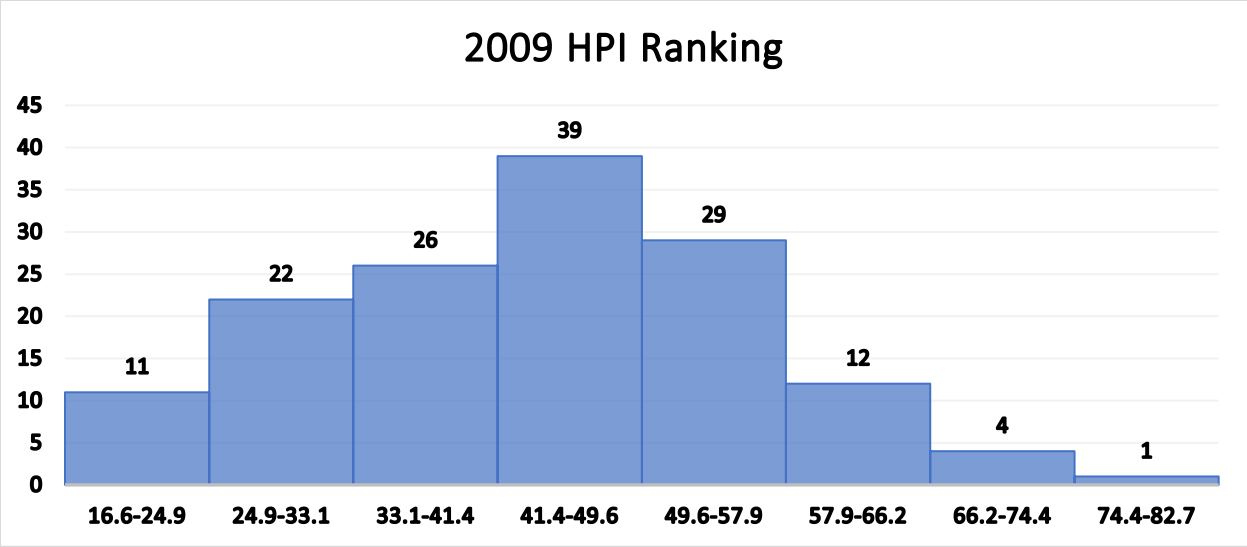
To see how well Ontario did compare to other countries, data from past HPI reports were used. There has been four HPI reports done by the New Economic Foundation in 2006, 2009, 2012, and 2016. The years that I focused on are 2009 and 2012. These two years were selected because their methods are more closely related to this study. In 2006, the NEF converted the

ecological footprint, life satisfaction and life expectancy to a 0-1 scale modeled after the Human Development Index, where 0 will be the equivalent to a 0 in life satisfaction; 25 years and below in life expectancy; and over 15 gha in ecological footprint, and 1 will be a 10 for life satisfaction, 85 years and over for life expectancy, and 1.71 gha and below in ecological footprint (NEF 2006). In 2016 it changed its mentions to incorporate in inequality of outcome. Inequality of outcome is a percentage used to adjust subjective wellbeing and life expectancy. This adjustment is used since the distribution of welfare and life expectancy is not equal among the citizens in the country (NEF 2016).

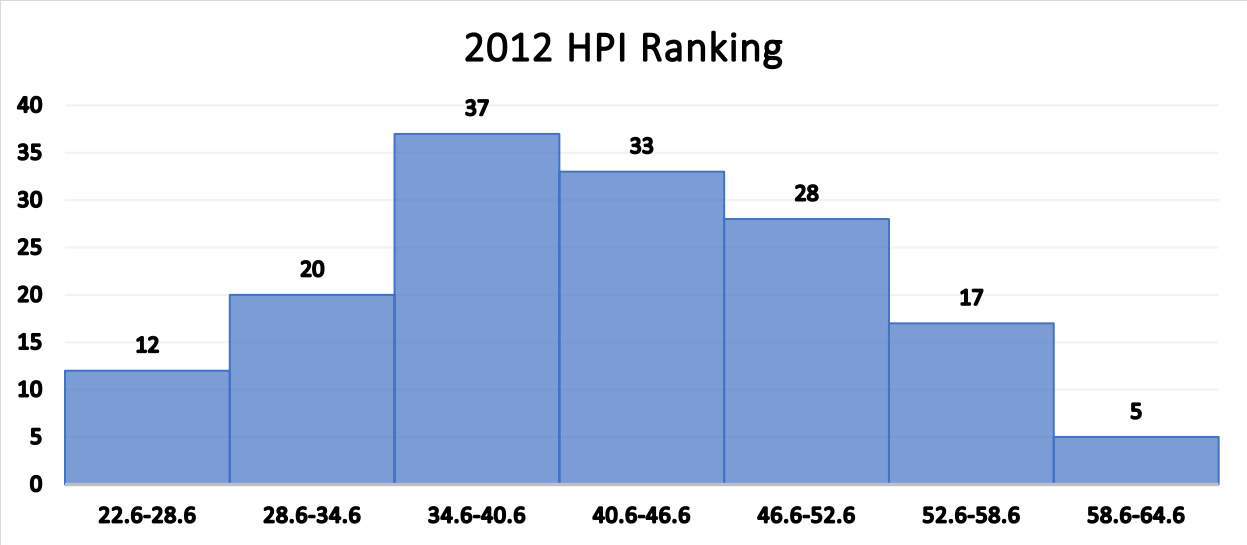
The New Economics Foundation uses a ranking system to demonstrate how well countries do in their HPI. When comparing Ontario with the other countries, a few adjustments are needed in the formula. First, I will have changed the formula to the original formulas. Instead of using health-adjusted happy life years, I have to unadjusted happy life years. Second, for the ranking system, three consent variables are added to the overall calculation (α,β, and γ), where α represent a value in reach if life satisfaction is 10, life expectancy is 85 years and over, the ecological footprint is 1.71 gha and less, the country will score 100. β represents a value if life satisfaction is 0, life expectancy is 25 years and below, the ecological footprint is 15 gha and over, the country will score 0 (Abdallah, Thompson, et al. 2009). γ was added to the ecological footprint, so the coefficient of variance in the entire dataset matches with Happy life years coefficient of variance. This was done because the variation in the ecological footprint data was more significant that the Happy life years data (Abdallah, Thompson, et al. 2009). The formula to calculate the HPI score is below.

HPI Score = $\alpha*((HLY-\beta)/EF+\gamma)$

Ontario's HPI score was 46 at a ranking of 63 in 2009 and 49.3 at a ranking of 36 in 2012. Ontario ranked better than 57 percent of countries in 2009 and 77 percent of countries in 2012. To present the results for the 2009 and 2012 HPI score, a histogram was made to display the distribution of outcomes (Graph 7 and 8). 2009 has a bell-shaped distribution, and 2012 has a right-skewed distribution.



Graph 7 Distribution of Countries' 2009 Happy Planet Index Score (Abdallah, Thompson, et al. 2009)



Graph 8 Distribution of Countries' 20012 Happy Planet Index Score (Abdallah, Michaelson, et al. 2012)

Ontario, for both years falls in the middle, where a lot of the developed countries are ranked. Typically, these countries achieve long happy life years as well as high ecological footprints. Developed countries will have high standards of living and life satisfaction at the cost of the environment. Table 2 below shows that the top ten countries in 2012with the high life satisfaction corresponding with its HPI score. The reason that these countries ranked well in life satisfaction but other than Costa Rica ranked way below because they usually practice weak sustainability. Weak sustainability is a model that assumes the interaction of human and natural systems occur in distinct and infinite spaces (Giannetti, et al. 2014). Weak sustainability is built on the assumption of the substitutivity of natural capital. If investing in manufactured and human capital is beneficial

to the public at the cost of the decline of natural capital, sustainable development policy is not necessary. But, if this is not the case, a measure such as regulations, subsidies, and taxes will be implemented (Neumayer 2010). Solow believes "earlier generations are entitled to draw down the pool so long as they add to the stock of reproducible capital." Proponents of weak sustainability hold that:

- Natural resources are unlimited both as an input into the production of consumption goods and a provider of direct utility;
- or the elasticity of substitution human-made capital human and built capital for resources are in the production function is equal to or greater the

In this model, the consumption of natural capital can be justified if transformed into another form of capital that provides economic and social good (Neumayer 2010). Developed countries have a more incremental change in environmental policy since it can interfere with the way of living for individuals in these countries.

Country	WHR Avg. LS Ranking	HPI Ranking
Costa Rica	1	1
Denmark	2	111
Ireland	3	74
Norway	4	29
Finland	5	71
Canada	6	66
Switzerland	7	34
Sweden	8	53
Australia	9	77
USA	10	106

Table 3 Comparing The Top Ten Countries with the highest life satisfaction ranking to their HPI ranking in 2012 (Helliwell, Layard and Sachs 2017)

Overall, Ontario's Happy Planet Index has been shown to have a steady increase throughout the year for the most apart because of a decrease in the ecological footprint. The use of this index can be possible in the future since the current Ontario government, under their new climate change action plan revealed that they would be conducting a climate change impact assessment. This assessment will provide information to the government and other stakeholders on the risk and vulnerability of certain aspects in Ontario. This assessment follows the United Kingdom's climate change impact assessment which provides an analysis on the risk climate change opposes on critical economic sectors, infrastructure, the environment, and societal health and well-being (Ministry of the Environment, Conservation and Parks 2018). Incorporating the HPI into this will

be a significant step in determining when Ontario will achieve sustainable wellbeing. The plan also proposes creating a user-friendly tool for many stakeholders in Ontario to understand the consequences of climate change. This tool can be used as a form of tracking progress towards sustainable wellbeing. Using the indicators for the happy planet index should be a start to use to build this online tool. This has brought up in the paper that most of the data used in this research are not accessible. In the following section, I have a recommendation for the Ontario government to follow to help achieve sustainable wellbeing using what they set out in their plan and based on this research.

Sustainable Development Measures in Policymaking

The popularity of Sustainable Development in government policy rose in 1987 from the United Nations World Environmental Commission report "Our Common Future" also known as the Brundtland report. This report produces the most common definition of sustainable development as the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations World Commission on Environment and Development 1987). Because this board definition of sustainable development, governments adopt their interpretation of sustainable development without the departure of economic growth as the top policy objective (Victor 2019). In 2006, Jim MacNeil, one of the authors of the reported comment on this issue.

> "I also never thought that the concept of sustainable development could and would be interpreted in so many ways… I no longer shock easily, but to this day, I remained stunned ay what some governments in their legislation and some industries in their policies claim to be sustainable development… We defined it in several ways – ethical, social, ecological…Only one definition grabbed the headlines, however, and stuck, unfortunately to the exclusion of others. It's the one that features the need for intergenerational equity…development, which meets the needs and aspirations of the present generations without compromising the ability of future generations to meet their own needs." (Victor 2019)

The three main components of sustainable development are economic growth, environmental protection, and social equity, but as mentioned, with government construing their focus on sustainable development, they continue to have economic growth as the top priority. The results in the continuation of resource extraction and not addressing social issues such as income

inequality and housing. Sustainability policies are more focus in terms of incremental policy change, creating new strategies that only change through several different steps without a significant shift in everyday life for citizens.

But as years pass sustainable development has been a top issue for citizens, and they demand fast pace actions by the government instead of incremental feats. There is a demand for a systemic collection of data on sustainability. As we are transitioning into a low carbon economy, they need to develop tools to assess progress. The government can accomplish this by creating a program that investigates socio-ecological systems and environmental efficiency. The Ontario government can build an Accounts of Wellbeing. An Accounts of Wellbeing is an approach developed by the New Economics Foundation to measuring social progress that incorporates wellbeing and ecological sustainability. The accounts will help to provide policymakers a better understanding of the impact of their decisions. This will help citizens as well to have wellbeing data in one place. This was an issue mentioned previously in my HPI data collection. The data comes from various sources and most of them are inaccessible.

A format of an Accounts of Wellbeing for Ontario to follow is the one published by the United Kingdom's Office of National Statistics which they called. Measuring National Well-being. The information is displayed in a dashboard-style format using Excel. This wellbeing account contains ten domains (personal wellbeing, our relationships, health, what we do, where we live, personal finance, the economy, education and skills, governance, and the natural environment) In total it contains 41 indicators.

Domain	Worksheet	Measure	Period	Data	Period	Data
Personal well-being	1.1	Very high rating of satisfaction with their lives overall	Oct 2015 to Sep 2016	29.3%	Oct 2014 to Sep 2015	29.1%
	1.2	Very high rating of how worthwhile they feel the things they do are	Oct 2015 to Sep 2016	34.6%	Oct 2014 to Sep 2015	34.5%
	1.3	Rated their happiness yesterday as very high	Oct 2015 to Sep 2016	34.4%	Oct 2014 to Sep 2015	34.2%
	1.4	Rated their anxiety yesterday as very low	Oct 2015 to Sep 2016	40.4%	Oct 2014 to Sep 2015	41.3%
	1.5	Population mental well-being	2012 to 2013	24.6/35	2009 to 2010	25.2/35
Health	3.1	Healthy life expectancy at birth (male/female)	2013 to 2015	63.1 (male) 63.9 (female)	2011 to 2013	62.9 (male) 63.7 (female)
	3.2	Percentage who reported a disability	Oct to Dec 2016	17.7%	Oct to Dec 2015	17.3%
	3.3	Mostly or completely satisfied with their health	2014 to 2015	49.6%	2013 to 2014	44.6%
	3.4	Some evidence indicating depression or anxiety	2014 to 2015	17.3%	2013 to 2014	19.7%
The natural environment	10.1	Total green house gas emissions (millions of tonnes of carbon dioxide equivalent)	2015	495.75	2014	515.13
	10.2	Protected areas in the UK (Millions hectares)	2015	21.4	2014	21.4
	10.3	Energy consumed within the UK from renewable sources	2015	8.3%	2014	7.1%
	10.4	Waste from households that is recycled	2015	44.3%	2014	44.9%

Figure 1 Examples of the UK Measures of National Wellbeing

For this program to be successful, it needs to be transparent about the success of government policies. Increasingly, stakeholders such as citizens, non-profit organizers, and elected officials what to know how well a program works, since it's publicly funded. A comprehensive program evaluation model needs to demonstrate how well the government is working to achieve sustainability goals. Program evaluation is the application of systematic methods to address questions about policy and program operations and results as well to identify ways to improve the policy and program under evaluation (Newcomer, Wholey and Hatry 2015). A useful method to evaluate the program is to use performance measurements. Performance measurements are evaluation tools and management systems designed to provide feedback on performance to strengthen decision making & improve programs (Poister 2015). The three components of HPI are good examples of performance measurements to use for the development of an Accounts of Wellbeing. For performance measurements to be used successfully, a measurement system is needed. Performance measurement systems are designed to track measures of the program at regular periods and report these findings to stakeholders to provide transparency and accountability to policymakers to improve the decision-making process (Poister 2015). A performance measurement system suited for Ontario to use might be one designed for Federal Ministries, called the performance measurement strategy framework. It is a management tool that is used to guide the selection, development, and ongoing use of performance measures (Centre of

Excellence for Evaluation 2010). The critical components for a performance measurement strategy are the performance measurement strategy framework, program profile, logic model, and an evaluation strategy. The next section would provide an example of what the performance measurement strategy framework will look like if it was implemented in Ontario. In the Appendix, it explains more in detail program the performance measurement strategy framework.

Ontario Accounts of Wellbeing Program

Over the years, Ontario has been going through a phase of transition to a green economy. Been able to reduce its consumption of natural resources a develop renewable energy projects. The transition to a green economy should not only look at the development side of things but also how we measure progress. We tend to look at GDP and economic growth as the sole measure of progress in a country. The issue is GDP doesn't give a clear idea about issues directly affect citizens. Alternative indicators to GDP exist to meet better the goal of measuring progress towards sustainable development. This requires a new program to evaluate Ontario's transition to a green economy better. The program is called the Ontario Wellbeing Measurement Program which will be administered by the Ministry of the Environment, Conservation, and Parks

The objective of this program is to assess the impact climate change has on environmental, social, and economic systems. This will align with the government's goals in their Climate Change Plan to improve the understanding of climate change for Ontarians by creating an online tool that will provide information of the impact of climate change to several stakeholders (businesses, municipalities, policymakers, and several communities) more accessible. This will happen through a provincial impact assessment to detect where and how climate change is likely to impact Ontario's communities, infrastructure, economies and natural environment (Ministry of the Environment, Conservation and Parks 2018).

Performance Measurement Strategy Framework

Program Outputs and Outcomes	Indicators	Data Source	Frequency	Baseline	Target	Date to achieve the target	Data Management systems
Accounts of Wellbeing	Life Satisfaction	Canadian Community Health Survey	Annually	7	10	n/a	MySQL

	Health-adjusted Life Expectancy	Statistics Canada and the Canadian Community Health Survey	Annually	n/a	85 years	n/a	MySQL
	Gross Domestic Product	Statistics Canada	Annually	n/a	n/a	n/a	MySQL
	Ecological Footprint	Global Footprint Network	Annually	n/a	1.73 gha	2050	MySQL
	Greenhouse Gas Emissions	Statistics Canada and Canada's Greenhouse Gas Inventory	Annually	n/a	Net-zero emissions	2050	MySQL
	Gini Coefficient	Statistics Canada	Annually	n/a	n/a	n/a	MySQL
The Happy Planet Index Report	The Happy Planet Index	Canadian Community Health Survey, Global Footprint Network, Stats Canada	Annually	n/a	49.1 Happy Life Years/gha	2050	MySQL

Evaluation Strategy

Question	Indicator	Data Source and Methods	Baseline Data	Timelines for Data Collection
How many years of individuals in Ontario are live long, happy, healthy lives	Happy Life Years (HLY)	Life satisfaction and health-adjusted life expectancy data collected in the performance measurement framework database. The following formula is used to calculate it, HLY= (Life Satisfaction* Health-adjusted	56 Happy Life years	One week

		Life Expectancy)/10		
How efficient was Ontario in increasing wellbeing while not over-consuming natural resources?	Happy Planet Index	Happy Life Years calculation above and ecological footprint in the performance measurement framework database. HPI = Happy Life Years/Ecological Footprint	10 Happy life Years/gha	One week
Is the Ontario economy not relying too much on CO_2 emissions?	CO_2 Intensity	CO_2 emissions and GDP data in the performance measurement framework database. CO_2 Intensity = CO_2/GDP	0.000385386	1 week

Conclusion

Transitioning to a low carbon economy signifies one of the utmost substantial and urgent challenges facing Ontarians today. The transition will require a paradigm shift in the evaluation of how Ontario handles natural resources and development. There are measures used by governments that contain only a monetary approach to measure wellbeing or a social approach. According to some, these indicators express weak sustainability (Giannetti, et al. 2014). Examples include the Human Development Index and the Genuine Progress Indicator since they focus on societal progress, but they do not establish thresholds of ecological limits (Giannetti, et al. 2014) and (Schepelmann, Goossens and Makipaa 2010). Generally, the consumption of natural capital is seen as acceptable if it is transformed into human, social, and manufactured capital. However, environmental indicators are strongly linked to strong sustainability since they determine the limits of natural capital. Other forms of capital can't grow beyond the boundaries of natural capital in

the biosphere as well since they are not substitutes but complement each other. That is why ecological indicators must be included in any form of wellbeing evaluation. Having a socio-ecological perspective in measuring progress is needed to measure wellbeing.

Even though GDP is flawed when it is used to measure socioeconomic outcomes, it still may have a place to be used by the government in other areas. It provides information on the economic output, income, and expenditure of countries and these are important to comprehend and formulate fiscal and monetary policies. The HPI is great in measuring progress in a socio-ecological lens. But it fails to indicate or quantify objective forms of wellbeing that people are also curious about, such as income, homeownership, educational degree, and the location of residence. That is why no one indicator is perfect for measuring strong sustainability, and it will be best for Ontario in the future to use multiple indicators to capture its progress toward sustainability.

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Appendix: Performance Measurement Strategy Framework

Program Profile

A program profile is used as a reference for evaluators and stakeholders to get gain a quick overview of the program. The table below contains elements needed for a program profile.

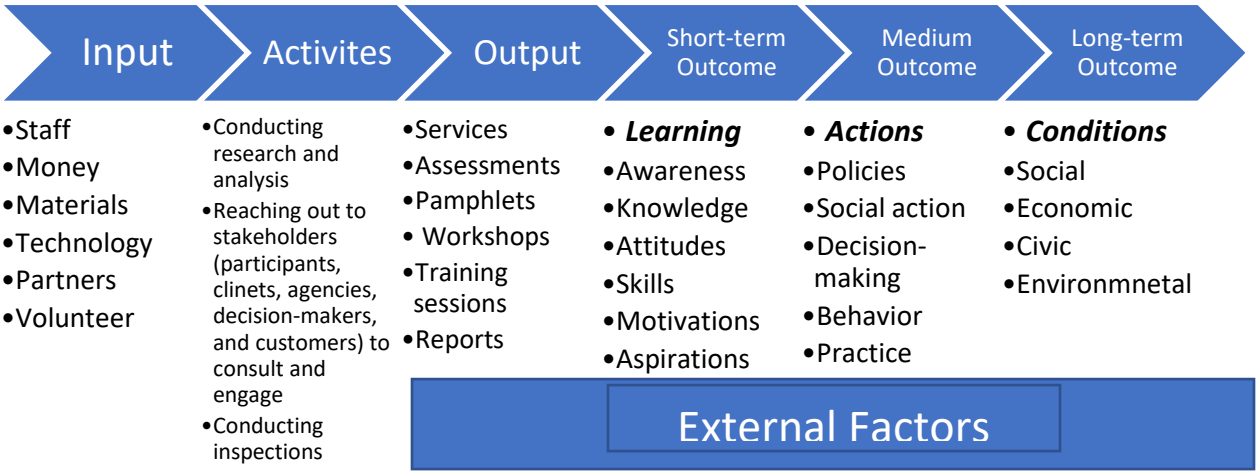
Need for the program	Explain the need for the program by presenting information such as demographic and research studies to support its purpose
Alignment with government priorities	Displays the objectives of the program which align with government priorities.
Target population	Identify the population(s) who will be influenced and benefit from the program. It will also investigate other characteristics that may hold importance to the program. Ex. geographic area, age groups, gender, income, education
Stakeholders	Identify program stakeholders
Governance	Identify the role and responsibilities of the government, third-party partners in delivering the program in performance monitoring, reporting, and evaluation.
Resources	Identify resources required for implementing performance monitoring of the program and the estimated costs for conducting the evaluation

Logic Model

A logic model displays how a program will work under certain environmental conditions to solve problems in applications (McLaughlin and Jordan 2015). A logic model is represented visually in a tabular form to display how a program is intended to work, the resources needed for the program activities, and the goals it hopes to achieve. A logic model is made of three parts, the program structure, outcome structure, and context. The program structure is elements of the logic model that were decided during the design phase of the program. The outcome structure is the multiple outcomes that can produce changes or benefits to the program's target population. Contexts are external factors that are not under the control of the program but can influence its success in a positive or negative matter.

The parts of the logic model are further broken down into eight components: input, output, short-term outcome, intermediate outcome, long-term outcome, antecedent factors, and mediating factors. The input is resources (financial or non- financial) used in delivering activities. Activities

are the actions an organization will take on to produce outputs. Outputs are the goods, services, and products for the use of the program target population. Short-term outcomes are directly related to the outputs. Intermediate results are expected to occur. These types of issues more focus on behavioral changes that are increased awareness and knowledge of the subject. Long-term outcomes are program impacts scheduled to happen from the benefits accrued through several intermediate issues. Antecedent factors are those a program starts with such as economic factors, geographical variables, and stakeholders' characteristics. Mediating factors are influences as the program progresses such as a change in the program staff, new policies introduced by the government, changes to the economy, and new programs that may have a direct or indirect effect on the program or target population. The figure below displays an example of a logic model.



Performance Measurement Strategy Framework

The PM Strategy Framework identify and plan how the indicators required to monitor and measure the performance of a program will be collected. Its goal is to support the program by:

1. continuously monitoring and assessing the results of programs as well as the efficiency of their management;
2. making informed decisions and taking appropriate, timely action concerning programs;
3. providing adequate and relevant departmental reporting on programs; and
4. ensuring that the information gathered will effectively support an evaluation (Centre of Excellence for Evaluation 2010).

The table below display the components of the PM strategy framework. The program's outputs and outcomes defined in the logic model are to be included. For each indicator used for

the outputs and outcomes, they need the following information: the data source(s), the frequency of data collection, baseline data, targets and timelines for when objectives will be achieved, the organization, unit, and position responsible for data collection, and the data management system used.

Program Outputs and Outcomes	Indicators	Data Source	Frequency	Baseline	Target	Date to achieve the target	Organization and position responsible for data collection	Data Management systems
Output 1	Indicator 1							
Output 2	Indicator 2							
	Indicator 3							
Outcome 1	Indicator 4							
Outcome 2	Indicator 5							
	Indicator 6							

Evaluation Strategy

The Evaluation Strategy is a working model that outline the evaluation strategies for a program based on the information available at the start of the program (Centre of Excellence for Evaluation 2010). This strategy contains the preliminary evaluation framework, which provides evaluation questions and identifies the data required to address these questions.

Question	Indicator	Data Source and Methods	Baseline Data	Timelines for Data Collection
Question 1	Indicator 1			
Question 2	Indicator 2			
Question 3	Indicator 3			
Question 4	Indicator 4			