

Innovation Network Policy in Canada: Federal and Provincial Differences

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Abstract

Innovation network policy is a type of industrial policy that first emerged in the 1980s. The goal of innovation network policy is to establish connections between private enterprises, universities, public research institutions, and other innovative organizations, thereby stimulating collaborative innovative activity. In Canada, both federal and provincial governments have fully embraced this form of industrial policy, forging inter-organizational connections through a variety of policy tools and programs. Some of these programs fund collaborative research projects and research consortia that bring together innovative organizations across the country. Others create and fund physical innovation spaces, such as innovation hubs, technology incubators, and science parks. Although many Canadian scholars have examined federal and provincial innovation network programs, none have ever compared them in a rigorous and systematic way. This dissertation seeks to conduct such a comparison; using qualitative research methods, it aims to determine whether federal and provincial innovation network programs are different from each other and, if so, why. The main finding is that federal and provincial programs are, in fact, different in two key ways. First, they target innovative organizations in different industries or areas of technology. Second, they both fund physical innovation spaces, but do so in different ways; federal programs provide these spaces with capital funding, while provincial programs provide them with operational funding. These differences in policy approach reflect the different geopolitical and historical-institutional realities facing federal and provincial governments.

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List of Acronyms

ACAMP	Alberta Centre for Advanced MNT Products
ACOA	Atlantic Canada Opportunities Agency
ACCTC	Alberta Carbon Conversion Technology Centre
AHFMR	Alberta Heritage Foundation for Medical Research
AIEE	Alberta Innovates—Energy and Environment Solutions
AIHS	Alberta Innovates—Health Solutions
AITF	Alberta Innovates—Technology Futures
AMII	Alberta Machine Intelligence Institute
AMO	Association of Municipalities of Ontario
AOSTRA	Alberta Oil Sands Technology and Research Authority
AVIN	Autonomous Vehicle Innovation Network
ARD	Applied Research and Development
BL-NCE	Business-Led Networks of Centres of Excellence
CASES	Centre for Advanced Studies in Engineering and Sciences
CDC	Canada Development Corporation
CECR	Centres of Excellence for Commercialization of Research
CFI	Canada Foundation for Innovation
CIHR	Canadian Institutes of Health Research
CUFTA	Canada-US Free Trade Agreement
DREE	Department of Regional Economic Expansion
DRIE	Department of Regional Industrial Expansion
ERIN	Edmonton Regional Innovation Network
FIRA	Foreign Investment Review Agency
FTA	Free Trade Agreement
ICT	Information and Communication Technology
IRDIA	Industrial Research and Development Incentives Act
ISED	Ministry of Innovation, Science, and Economic Development
ISI	Innovation Supercluster Initiative
ISTC	Industry, Science, and Technology Canada
MARIOS	Materials and Reliability in Oil Sands Consortium
MEDJCT	Ministry of Economic Development, Job Creation, and Trade
MITI	Ministry of International Trade and Industry (Japan)
MRC	Medical Research Council
MRI	Ministry of Research and Innovation
NAFTA	North American Free Trade Agreement
NCE	Networks of Centres of Excellence
NEP	National Energy Program
NOHFC	Northern Ontario Heritage Fund Corporation
NRC	National Research Council of Canada
NRF	National Research Foundation (Singapore)
NSERC	Natural Sciences and Engineering Research Council
OCE	Ontario Centres of Excellence
OCI	Ontario Centre for Innovation
OVIN	Ontario Vehicle Innovation Network

PAIT	Program for the Advancement of Industrial Technology
RDA	Regional Development Agency
RIC	Regional Innovation Centre
RIN	Regional Innovation Network
RRC	Regional Research Centre (Korea)
RTD	Research and Technological Development
SAGD	Steam-Assisted Gravity Drainage
SDTC	Sustainable Development Technology Canada
SIF	Strategic Innovation Fund
SONAMI	Southern Ontario Network for Advanced Manufacturing
SPF	Sector Partnership Fund
SSHRC	Social Sciences and Humanities Research Council
STI	Science, Technology, and Innovation
TAC	Technology Access Centre
UFA	United Farmers of Alberta
VCR	Voluntary Challenge and Registry Program
WD	Western Economic Diversification

Chapter 1: Introduction

Throughout the 1980s and 1990s, governments in both advanced industrialized countries and late developing countries were forced to rethink their economic development strategies. In a world of international free trade and footloose multinational corporations, governments could no longer use the economic development policy tools that predominated in previous decades, such as tariffs and capital controls (Sharaput, 2010, p114; Pirie, 2013, p157; Streeck, 2017). Instead, governments adopted a new kind of development strategy based on earning competitive advantages in the global economy through innovation. A new strategy required new tools. Amongst the most important are those based on the idea of ‘networking’. Through various policies and programs, governments sought to establish links between firms, universities, and research institutions, hoping that these various organizations would share scientific and technical knowledge, equipment, and personnel (Freeman, 1987, p123; Lee, 2001, p30; Falck, Heblich & Kipar, 2010, p575). By sharing such resources, it was thought, these organizations would develop new products and technologies very quickly, and successfully bring them to market. In Canada, governments at both the federal and provincial levels fully embraced this new economic development strategy in the late 1980s, introducing programs that brought innovative organizations together and fostered collaboration between them (Fisher, Atkinson-Grosjean & House, 2001; Bradford, 2003; Sa & Litwin, 2011). These programs have taken many different forms over the years. Some have involved the creation of physical spaces, such as science parks and business incubators, where entrepreneurs, academics, and researchers from different organizations engage in face-to-face interaction. Others involve the funding of inter-regional or inter-provincial research partnerships and consortia, or the sponsoring of ‘superstar researchers’

who can mediate between the academic and industrial worlds. Regardless of their particular design, these programs all aim to create ‘innovation networks’ capable of generating, disseminating, and commercializing scientific and technological ideas, so as to earn Canada and the various provinces a competitive advantage through innovation.

Federalism’s impact on Canadian life is pervasive (Stevenson, 2004, p1). Almost all major policy areas have a federalism dimension in Canada, with both the federal and provincial governments playing a role. Examples include: health care; social welfare; labour markets; energy and climate change; the economy and economic development; and even international trade (Fierlbeck & Lahey, 2013; Van Den Berg et al., 2017; McIntosh, 2000; MacDonald 2020; Skogstad and Wilder, 2020; Kukucha 2008). Since the mid-1990s, many scholars have written books and articles on public science and technology programs in Canada, some of which have discussed the attempts by federal and provincial governments to create innovation networks (Bell, 1996; Fisher, Atkinson-Grosjean & House, 2001; Niosi & Bas, 2004; Doern, Castle & Phillips, 2016; Castle & Phillips, 2022). None of these works, however, have compared innovation network initiatives at the federal and provincial levels, or have explored whether federal and provincial governments have different approaches to promoting innovation networks. This dissertation aims to fill this gap in the literature by systematically cataloguing, comparing, and contrasting federal and provincial innovation network initiatives from the mid-1980s to the present day. It also seeks to understand *why* federal and provincial governments may pursue different innovation network initiatives, paying particular attention to geopolitical factors (federalism, regionalism, inter-governmental relations) and historical-institutional factors. Qualitative research methods, specifically interviews and document analysis, are used to gather information about federal and provincial initiatives and programs.

This dissertation explores factors affecting Canada's federal and provincial government preferences for different innovation network initiatives and programs. These governments may, for example, face different geopolitical conditions. Under Canada's federal political system, they oversee jurisdictions with very different population sizes, geographical dimensions and characteristics, industrial compositions, and regional political dynamics. Equally important, they have much different relationships with cities and municipal governments. And of course, the federal government is concerned with regional economic equality, because of the threat to national unity that inequality poses. Perhaps federal and provincial governments adopt innovation network programs that suit or reflect their different external geopolitical realities. Alternatively, these governments may prefer different innovation network programs because they possess different internal institutional characteristics. For example, they may possess different bureaucratic structures and legislative mechanisms, or follow different policymaking practices, procedures, and traditions. They may also have different past experiences with economic and industrial policy, which may influence their respective approaches to promoting innovation networks. For many decades, political scientists have debated whether public policy decisions are shaped more by *external* societal factors (geopolitics, economic trends, class relations, pressure from social groups and 'interest groups') or *internal* institutional factors (governmental norms, practices, structures, and histories) (March & Olsen, 1984; Skocpol, 1985; Caporaso & Levine, 1992, p181; Evans, 1995; Peters, 1998). This dissertation directly engages with this debate by exploring how both external and internal factors shape and influence decisions about innovation network policy in Canada. One of the key findings of the dissertation is that external and internal factors are equally important in determining policy decisions.

This dissertation not only engages with a debate about policy formation and government decision-making, but also with a debate about industrial innovation and industrial policy in the modern age. Industrial innovation refers to the creation of new consumer products or the improvement of existing products, as well as the creation of new productive technologies that increase industrial output and lower the costs of production. As many scholars of innovation systems have pointed out, industrial innovation is an interactive and collaborative process; most new products and technologies are created by private enterprises working in conjunction with universities, public research institutions, venture capital firms, and other innovative organizations (Lundvall, 1988; Nelson, 1990; Edquist & Johnson, 1997; Freeman, 2010). While this inter-organizational collaboration takes place in all industries to some degree, it is most visible in modern high-tech industries, such as information technology, computer software, biotechnology, digital media, and microelectronics. Innovative organizations work together by sharing technical knowledge, swapping ideas and designs for new products and technologies, and helping each other solve complex technical challenges.

Since the 1980s, governments around the world have recognized the collaborative or communal nature of innovation. Many have sought to stimulate innovation in key industries by establishing connections between private, public, and nonprofit organizations. These connections have been created by funding research consortia and collaborative research projects, facilitating inter-organizational knowledge exchange and technology transfer, and building physical spaces where collaborative innovative activity can take place. This dissertation argues that government efforts to connect innovative organizations, or to create innovation networks, represent a modern form of industrial policy. Industrial policy is a specific type of economic policy that first emerged in Britain during the early nineteenth century and spread to other countries. The goal of industrial

policy is to develop, expand, and modernize important industries and economic sectors through targeted government interventions (Di Maio, 2014). Some mainstream and critical scholars believe that industrial policy was totally rejected and abandoned by most governments during the period of global economic liberalization or ‘neoliberalism’, which lasted from approximately 1980 to 2010 (Dosi, 2016; Lauridsen, 2016; Buzdugan & Tuselmann, 2018; Irwin, 2023). According to these scholars, industrial policy has experienced a slight revival since the mid-2010s. Contrary to these scholars, industrial policy never disappeared during the neoliberal period, but simply transformed and evolved. Throughout this period, governments continued to promote key industries and economic sectors through innovation network programs and initiatives.

The remainder of this chapter draws topical boundaries around the dissertation; it explains what topics the dissertation addresses and, equally important, what topics it does not address. The chapter then introduces the concept of ‘innovation networks’, and places this concept within its historical context. It explains how partnerships between firms, universities, and public research organizations became increasingly common and visible in the 1980s and 1990s, prompting economists and economic geographers to develop theories about innovation networks and clusters. It also explains how governments during this time became quite interested in creating and promoting innovation networks, which they saw as powerful engines of economic growth under conditions of global competition. After this, the chapter turns its attention toward Canada, briefly describing some of the federal and provincial programs that have aimed to create and expand innovation networks over the years. In the final section, the chapter provides a general summary and overview of the dissertation; it identifies the research questions, describes

the research methods, and discusses the main research findings. It also provides a breakdown of the seven chapters to follow this introduction.

Delimiting the Research

In the field of institutional economics, it is believed that innovation—defined as the creation of new products, technologies, and production processes—is enabled and facilitated by certain social, economic, political, and legal institutions (Edquist & Johnson, 1997). These institutions are deeply interconnected and interwoven, complementing and reinforcing each other. Together, they constitute a cohesive institutional framework or ‘system of innovation’ that drives, guides, and nurtures/supports the innovative process. A system of innovation is composed of many different elements, including organizations (firms, universities, libraries, public research institutes, research consortia, banks), government rules and policies (intellectual property laws, trade and competition laws, tax laws, public science and technology policies), and informal conventions (cultural norms around money, investment, risk, competition, and creativity). As Richard Nelson explains in his anthology book *National Innovation Systems: A Comparative Analysis* (1993), every country has its own distinct system of innovation that reflects its unique social, political, and economic history. Of course, not all innovation systems are of equal calibre. Some countries have more robust, sophisticated, and advanced innovation systems than others, causing disparities in levels of innovation around the world.

Systems of innovation were first studied by economists, economic geographers, and experts in international political economy in the late 1980s and early 1990s. At the time, these scholars were concerned with questions of national economic competitiveness and innovativeness; they wished to understand why some countries, like Switzerland and Japan, were more innovative than other countries, like Spain and Ireland. In order to explain these differences

in national innovation performance, they systematically examined and compared the characteristics of different *national innovation systems* (Lundvall, 1992; Patel & Pavitt, 1994; Freeman, 1995). For example, David Mowery and Nathan Rosenberg (1993) examined the characteristics of the American national innovation system, looking specifically at the country's industrial composition, educational system, human capital stock, and public R&D funding mechanisms. Not all scholars studied innovation systems at the national level, however; some focused instead on *regional innovation systems*—that is, innovation systems that exist within the boundaries of provinces, states, prefectures, and other subnational jurisdictions (Cooke, 1998). Some regional innovation systems that have received scholarly attention include those located in Baden Württemberg (Heidenreich & Krauss, 1998), Ontario (Wolfe & Gertler, 1998), Silicon Valley (Saxenian, 1996), and Lombardy (Muscio, 2006).

It is very important, for the purposes of this dissertation, to differentiate between a *system of innovation* and an *innovation network*. A system of innovation is very broad in scope, encompassing all of the organizations, rules, policies, and conventions in a country (or a region) that support the innovative process in some way. To quote Bengt-Åke Lundvall, “a system of innovation is constituted by elements and relationships which interact in the production, diffusion, and use of new, and economically useful, knowledge” (Lundvall, 1992). In contrast, an innovation network is simply a group of entrepreneurs, academics, product engineers, and other innovative actors from different organizations who work together to develop new products, technologies, and production processes. This group may be quite small, consisting of just a handful of individuals in a single city, or it may be very large, consisting of hundreds of individuals scattered across an entire region or country. While innovation networks stand apart conceptually from systems of innovation, they are structurally *embedded* within systems of

innovation. In other words, an innovation network is one of the constituent elements of a system of innovation. Most systems of innovation contain thousands of innovation networks of different sizes, compositions, and technological orientations. Public policies that create, fund, and grow innovation networks are also important elements of systems of innovation.

The goal of this dissertation, as explained above, is to uncover new information about innovation network policies in Canada. Specifically, it seeks to determine whether federal and provincial innovation network policies are different from each other, whether by targeting different kinds of networks or by using different tools to connect innovative actors and organizations. It also seeks to determine *why* federal and provincial policies are different. The dissertation thus focusses rather narrowly on one particular area of Canada's national and regional innovation systems: innovation networks and the public policies—both federal and provincial—that foster and support them. It does not explore the relationship between innovation networks (and innovation network policies) and other areas of Canada's innovation systems, such as tax laws, intellectual property laws, foreign investors, and venture capital. In addition, it ignores federal and provincial innovation policies/programs that do not directly relate or contribute to innovation networks. Some of these policies/programs which are not directly relevant include the Scientific Research and Experimental Development (SR&ED) tax credit, the Connecting Canadians Program, and the Innovation and Skills Plan. Although these initiatives promote the development of new products and technologies and help Canadians adapt to technological change, they do not bring innovative actors and organizations together within networks (at least not directly).

Chapter 6 of this dissertation describes, in great detail, the many innovation network policies carried out by Canada's federal and provincial governments since the mid-1980s. The

following two chapters consider how these policies have been guided in different directions by various geopolitical, historical, and institutional forces. Together, these chapters may help deepen and enrich our understanding of Canada's innovation system, or at least of one very important dimension of this system. They may also help explain Canada's poor innovation performance, which has been the subject of popular and scholarly debate for decades. As many economists have pointed out, Canada is less innovative than many other wealthy industrialized countries, such as France, Germany, Japan, and the United States (Schwanen, 2017; World Intellectual Property Organization, 2022). Canada's innovation deficit is demonstrated by its relatively low levels of worker productivity, multi-factor productivity, business expenditure on R&D, ICT investment per worker, and patent intensity (Council of Canadian Academies, 2009; Castle & Phillips, 2011). Interestingly, Canada produces world-class scientific research in the areas of environmental science, health science, natural resource utilization, and information technology. Unfortunately, it has not been able to commercialize this research or transform it into new products and production processes (Council of Canadian Academies, 2013). Some academics and economists have argued that Canada's innovation deficit reflects the failure of federal and provincial innovation policies, including innovation network policies (Stanford, 2011a; Smardon, 2014; Globerman & Emes, 2019).

The Emergence of Innovation Network Theory and Policy

The global economic order changed dramatically in the 1980s and 1990s with the development and proliferation of new information and communication technologies (ICT) (Jorgenson & Vu, 2016). This period saw rapid advances in computing, microelectronics, and digital networking, allowing individuals and organizations to exchange data across large distances and at lightning-fast speed (Monge, 1998, p146). As ICT became widely adopted by

corporations, the flow of goods, services, and capital greatly accelerated around the world, giving rise to a highly-interconnected and fast-paced global economy (Glenn, 1994). In North America, Western Europe, and east Asia, new ‘high-tech’ industries emerged and expanded, including telecommunications, biotechnology, computer hardware and software, and consumer electronics (Powell & Snellman, 2004). Each of these industries relied heavily on the exploitation of scientific and technical knowledge, whether that knowledge came from private R&D laboratories, universities, or public research institutions. Workers within these industries were expected not only to perform routine tasks, but also to regularly seek out and acquire new knowledge, and then apply this knowledge to the development of new products and production processes:

“Electronics industries utilize a distinctive raw material: knowledge. They have relied not only on highly creative scientific and engineering expertise for their initial development (that much has been true historically for most manufacturing industries), but also they have depended on continuing technological innovation as perhaps the primary basis of their competitive ‘edge’. Arguably then, knowledge, embodied in a particular form of labour power, has been the principal factor of production” (Henderson, 1989, p4).

As high-tech industries grew in the 1990s and became powerful drivers of economic growth, economists gained a deeper and more sophisticated understanding of innovation. Through a series of empirical studies, economists discovered that innovation (especially in high-tech industries) involves a process of ‘interactive learning’, in which various individuals and organizations share information about new scientific breakthroughs, technological opportunities, and consumer needs (Lundvall, 1992; Freeman, 1995). They also discovered that high-tech firms not only compete with each other (and sell goods to each other), but also frequently collaborate in the design, testing, and marketing of new products. In his article titled *Capitalism as an*

Engine of Progress, leading evolutionary economist Richard Nelson showed how inter-firm partnerships and R&D ventures are common in virtually all high-tech industries:

“Airframe manufacturers cooperate with electronics and engine manufacturers in the design and development of new aircraft. Computer and semi-conductor manufacturers often work together. A semiconductor producer that is strong on product design may share information and work together with another company whose process technology is stronger. A new biotech firm with a strong scientific staff but little production and marketing experience, and an established pharmaceutical company with limited in-house R&D expertise in a field where the new firm is strong, may get together on a project or group of projects” (Nelson, 1990, p206).

In order to develop a product that is both technologically sound and commercially viable, Nelson argues, a firm must establish and maintain close relationships with its suppliers, customers, and even competitors within the same industry. Even more importantly, it must embed itself within a science and technology ecosystem, whether by partnering with local universities and research institutions, or by encouraging its employees to join technical societies and associations. Oftentimes, high-tech firms sponsor research being conducted in universities so as to gain early access to new scientific and technical knowledge. Whenever firms, universities, research institutions, and other innovative organizations help each other develop new products or production processes, they can be said to constitute an ‘innovation network’.

One of the scholars most responsible for developing and popularizing the idea of innovation networks is Michael Porter, a Harvard economist whose influence extends well beyond the academic world. In his book *The Competitive Advantage of Nations* (1990), Porter observed how high-tech firms, investment firms, universities, and research institutions tend to concentrate geographically (or ‘cluster’) in particular cities and regions. Building upon Alfred Marshall’s theory of the ‘industrial district’ (Marshall, 2013 [1890]), Porter argued that spatial clustering provides many benefits to innovative organizations, allowing them to exchange information, technology, and other resources. Within an innovation cluster, engineers, product

designers, and researchers from different organizations can meet each other in person, form deep personal bonds, and work together to overcome complex technical challenges. In the late 1980s, as Michael Porter was writing his highly influential book, a large number of high-tech companies was established in the San Jose area of California. These companies frequently combined their technical knowledge and expertise, sometimes by swapping personnel and other resources (Saxenian, 1996). Through their collective efforts, these companies were able to invent revolutionary computer hardware and software, and transform the internet into a platform for buying and selling goods. As these companies drew worldwide recognition and praise, the San Jose area came to be known as ‘Silicon Valley’. For many economists and economic geographers in the 1990s, Silicon Valley clearly demonstrated the power of inter-firm collaboration and spatial clustering.

Just as economists realized the importance of innovation networks and clusters in the 1980s and 1990s, so did government bureaucrats and elected officials. All around the world, governments introduced programs to foster ties between firms, universities, and other innovative organizations, believing that such ties would increase investment in R&D and enhance national and regional economic performance. In 1995, the central government of South Korea began distributing special funds to universities across the country to help them set up research consortia called Regional Research Centres (RRCs). Each RRC brought together researchers from the academic, nonprofit, and industrial sectors, and focused on developing a particular technology, such as automobiles, medicine, robotics, semiconductors, and information technology (Lee, 2001). Research consortia were also created and supported by the federal government of Germany through its BioRegio program, and by the federal government of Australia through its Cooperative Research Centre program (Kaiser, 2003; Garrett-Jones, 2004). The Japanese

government has promoted innovation networks since the early 1980s through various programs, one of which is the Knowledge Cluster Initiative. Introduced in 2001 by the Japanese Ministry of Education, Science, and Technology, the Knowledge Cluster Initiative identified regions of Japan where many high-tech firms, universities, and research institutions are co-located. It then funded collaborative research projects, patenting efforts, seminars, and conferences within each region (Kondo, 2006). Similar programs were introduced by governments in the United States (Chatterjee, Glaeser & Kerr, 2014), Singapore (Suseno & Standing, 2018), France (Lenchuk & Alaskan, 2010), and Italy (Caligano & Fitjar, 2017). As governments across the globe have sought to create and expand innovation networks and clusters, their efforts have been endorsed by many economists, most notably Michael Porter, whose work now extends to advising governments on the design and implementation of innovation network/cluster programs (Porter, 2000). Other economists have taken a more critical and skeptical view of these initiatives, arguing that innovation networks and clusters should be formed ‘naturally’ and ‘organically’ — that is, without government involvement (Duranton, 2011; Kiese, 2019).

Before proceeding to the next section, it is important to note that there are two different types of innovation network: virtual networks and anchored networks. These networks rely on very different methods to connect innovative actors, such as entrepreneurs, academics, researchers, and investors. Virtual networks connect actors through electronic or virtual channels — most commonly email, video conferencing, and web forums — thus allowing them to communicate and interact across large geographical distances. Depending on the communication technologies and organizational methods they employ, virtual networks may encompass hundreds or even thousands of actors located in different places, and may span entire cities, regions, or even countries. Sometimes, all of the actors within a virtual network meet in person

to participate in conferences, workshops, and social mixers. In contrast, anchored innovation networks connect actors by housing them within a single physical space, whether that space is a research laboratory, science park, or business incubator or accelerator. Unlike virtual networks, which are geographically diffuse and disembodied, anchored networks are permanently tied (or ‘anchored’) to particular buildings, facilities, and campuses. By allowing actors to engage in regular face-to-face interaction with each other, anchored networks give rise to serendipitous collaboration and knowledge exchange.

Innovation Network Programs in Canada

Throughout its early history, Canada was scientifically and technologically stunted. Very few Canadian universities conducted scientific research or trained graduate students in scientific fields, and Canadian firms were heavily dependent on imported technologies and product designs, primarily from the United States (Smardon, 2014, p51). Canada’s scientific and technological capacity improved significantly during the two World Wars, as firms established their own laboratories for R&D and hired their own scientific staff. Universities introduced more graduate-level programs in science at this time, and became much more focused on research, especially in the areas of medicine and engineering (Niosi, 2000, p45). In 1916, the federal government created a new agency called the National Research Council (NRC), which employed hundreds of scientists and carried out fundamental research in a variety of areas, including chemistry, physics, biology, and bacteriology (Gridgeman, 1979; Doern & Lavesque, 2002, p46). The NRC accomplished many technological feats in the mid-twentieth century, most notably the creation of the cardiac pacemaker and Canada’s first electro-nuclear reactor. In the 1960s and 1970s, three ‘granting councils’ were created by the federal government: the Medical Research Council (MRC), the Natural Sciences and Engineering Research Council (NSERC), and the

Social Sciences and Humanities Research Council (SSHRC). The purpose of these organizations was to fund research in Canada's universities by providing grants to academic researchers on a competitive basis (Doern, Castle & Phillips, 2016, p167).

Until the mid-1980s, there was very little communication and interaction between private firms, universities, and government laboratories or research institutions in Canada. These innovative organizations occasionally came together to share information and technology, but did not engage in systematic collaboration or routine knowledge exchange. As Jorge Niosi explains in his book *Canada's National System of Innovation*, innovative organizations in Canada carried out R&D activities separately throughout most of the twentieth century:

“In the 1980s and 1990s, there was a radical change in the way in which R&D in Canada was managed by industry, government laboratories, and universities. Before 1980, these innovating units were often working in isolation from each other. There was some technological cooperation and transfer, but most R&D managers believed that this activity was too volatile to be conducted with the help of external units, let alone competitors. Besides, it was considered evident that universities should concentrate on fundamental research, public laboratories on applied research, and corporations on development. One way or another, knowledge would flow from universities to public laboratories, and then to companies, where it would be translated into new and improved processes and products. National prosperity would follow” (Niosi, 2001, p98).

As high-tech and knowledge-intensive industries emerged in the 1980s, Canadian academics, researchers, and entrepreneurs began to see inter-firm and inter-sectoral collaboration as an economic imperative. In order for Canada to be economically competitive, they believed, private firms, universities, and research institutions in all parts of the country must become partners in the innovative process. Many argued that new institutional mechanisms must be created to bridge the gap between Canada's industrial and academic/scientific domains. The Science Council of Canada, a public advisory committee made up of Canada's most prominent scientists, insisted that the federal government use its powers and resources to strengthen the relationship between private firms and universities (Fisher, Atkinson-Grosjean & House, 2002, p306). Heeding the

advice of Canada's scientific and business communities, the federal government introduced its first innovation network program in 1989: the Networks of Centres of Excellence (NCE) program. Managed by the three federal granting councils, the NCE program established links between innovative individuals located in universities, private firms, research hospitals, and government laboratories across Canada. These individuals conducted research in a range of different areas, from respiratory health and bacterial diseases to telecommunications and robotics (Networks of Centres of Excellence, 2004). According to Janet Atkinson-Grosjean, an expert in Canadian science policy, the NCE program was massive in scope, as it "linked some 460 companies with 900 researchers in 61 universities and 44 hospitals, more than 100 federal and provincial government agencies, and some 200 other organizations" (Atkinson-Grosjean, 2001, p80).

In the year 2000, the federal government established two new science and technology agencies, both of which are dedicated to creating innovation networks. The first agency, the Canadian Institutes of Health Research (CIHR), funds large-scale research projects focusing on nutrition, infection and immunity, aging, and other health-related topics (Canada Institutes of Health Research, 2004, p9). These projects are carried out by large interdisciplinary research teams, whose members are scattered among universities, hospitals, and research institutions across Canada. Communication between members occurs mostly through electronic channels, although there are sometimes in-person meetings. The second agency established in 2000 was Genome Canada, which funds research related to human, animal, and plant genetics. The aim of this research is not only to advance human knowledge about genetics, but also to help industry solve practical problems through the application of genetics-based tools and technologies. During its first year of operation, Genome Canada set up five regional branches throughout the

country: Genome Ontario, Genome Quebec, Genome BC, Genome Prairie, and Genome Atlantic (Doern, Castle & Phillips, 2016, p305). Every year, these regional branches assemble teams of researchers and engineers from different organizations (both public and private), and ask these teams to develop proposals for genetics research. The proposals are submitted to Genome Canada for evaluation, after which Genome Canada awards funds to those teams that it deems the strongest (Genome Canada, 2009, p30-35; Program Officer 3).

Although Canada's federal political parties have different preferences with regard to economic policy, they all recognize the value and importance of innovation networks. Since the late 1980s, innovation network programs have been launched by both of Canada's major federal parties—the Conservative Party launched the NCE program in 1989 (and expanded it in 2007), while the Liberal Party established CIHR and Genome Canada 2000 (and introduced the Innovation Supercluster Initiative in 2017). The idea that universities, firms, and research institutions must work together to create new products and technologies has become conventional wisdom among Canada's federal political class. This idea has also been embraced by provincial governments across Canada. For example, in 1992, the provincial government of Alberta released a policy document titled *Toward 2000 Together*, which called for greater cooperation between Alberta's high-tech firms and universities (Premier's Conference on Alberta's Economic Future, 1993). Over the next few years, the provincial government began actively promoting innovation networks, first by restructuring the Alberta Research Council (ARC), a provincially-funded research organization founded in 1921. Under the provincial government's new innovation agenda, ARC shifted its focus from conducting basic scientific research to funding industrial research consortia in telecommunications, wireless technology, and photonics (Garrett-Jones, 2007, p43). The provincial government also launched the Informatics

Circle of Research Excellence, a program which sought to attract high-profile researchers from around the world to Alberta. Once these researchers arrived in Alberta, they were expected to work closely with both universities and private firms, and serve as an intermediary between these organizations (Sa, 2010, p349). In 2010, a nonprofit organization called Alberta Innovates was created to support and expand Alberta's innovation ecosystem. With funding from the provincial government, Alberta Innovates created eight Regional Innovation Networks across the province. These virtual networks bring together universities, polytechnic institutions, local economic development corporations, and business incubators/accelerators to host workshops, share scientific and technical knowledge, and provide guidance and support to small and medium-sized technology companies (Director 7; Program Officer 8).

Like the provincial government of Alberta, the provincial government of Ontario has carried out a number of innovation network programs, the first one being the Ontario Centres of Excellence (OCE) program. Founded in 1987, the OCE program was the brainchild of the Premier's Council on Science and Technology, a committee of scientific experts chaired by David Peterson, the Liberal premier of Ontario. With an initial budget of \$204 million, the OCE program created seven research consortia, which conducted basic scientific research in areas such as manufacturing, telecommunications, lasers, light waves, and space and terrestrial science (Bell, 1996). Each consortium included multiple universities and research institutions, as well as industrial partners, which were partly responsible for setting the research agenda and allocating funds within the network. The Premier's Council hoped that the OCE program would help retain jobs in Ontario's traditional manufacturing sector, while also creating new jobs in Ontario's emerging science and technology sector. When Bob Rae became premier of Ontario in 1990, the provincial government continued to support innovation networks through the introduction of the

Sector Partnership Fund (SPF). Over the course of five years, the SPF encouraged firms in the same industry to work together on collaborative projects, including “research in new products and processes, development of sector-wide training standards, inter-firm associations for knowledge diffusion, and sector promotion and global marketing” (Bradford, 2003, p1016). In 2000, the provincial government began funding ‘biotechnology incubators’, facilities where small and medium-sized biotechnology companies could set up their offices and laboratories. By bringing different biotechnology companies together under the same roof, biotechnology incubators created opportunities for biotech researchers and engineers to meet each other and collaborate in-person.

Overview of Dissertation

This dissertation seeks to answer two different but closely related research questions. Firstly, do Canada’s federal and provincial governments have different approaches to creating, funding, and supporting innovation networks? Secondly, if these governments do have different approaches, why is this? Can these differences be explained by geopolitical, historical, or institutional factors? To answer these questions, interviews were conducted with 41 policymakers, program directors, and business development professionals at the local, provincial, and federal levels. Many interviewees were involved in the development and implementation of innovation network programs. Some worked for government ministries and agencies, while others worked for universities, nonprofit organizations, and local economic development corporations. At the same time, documents were collected from government ministries and other organizations, and then subjected to thorough analysis. It was impossible to include every province in this research project, given the limited time available for data collection and writing, and the limited number of pages expected of a dissertation. As a result, Ontario and Alberta were

the only provinces taken into consideration. These particular provinces were chosen because they both have very robust economies—together, they account for approximately sixty-five percent of Canada's gross domestic product. Along with Quebec, these two provinces are home to many knowledge sector industries and high-tech industries, and have adopted many innovation network programs over the years.

Throughout the research process, it was discovered that federal and provincial governments pursue different innovation network strategies, most notably by creating and supporting innovation networks in different industrial or technological sectors. The federal government focuses on networks in the agricultural and health sectors, the Ontario government focuses on networks in the manufacturing sector, and the Alberta government focuses on networks in the agricultural and energy (oil and gas) sectors. Using the research data collected, a theory was developed to explain *why* these governments target networks in different sectors. This theory emphasized the different industrial policy histories and experiences of the federal, Ontario, and Alberta governments. The federal government targets health and agricultural networks, according to this theory, because many of its past industrial policies have centred around health and agriculture. Similarly, the Ontario government targets manufacturing networks because the manufacturing sector has been the primary focus of industrial policy in Ontario since the late nineteenth century. Another important finding was that federal and provincial governments both fund anchored innovation networks, however they provide these networks with different kinds of funding. The federal government mostly provides them with short-term capital funding, while provincial governments provide them with long-term operational funding. The reason why these governments have different funding relationships with anchored networks is because they operate under different geopolitical conditions and logics. This point will be

elaborated upon in future chapters. As we can see, this dissertation not only seeks to understand the similarities and differences between federal and provincial innovation network initiatives, but also to explain *why* these initiatives are different (or not different) through the development of new theories. One could describe the dissertation, therefore, as an *inductive* or *exploratory* research project. The inductive approach places an emphasis on gathering together evidence so as to ensure the researcher has a complete picture of the cases under investigation, and then the research proceeds to develop a theoretical explanation for what they found. This contrasts with the deductive approach, where one begins with theorization and then only collects evidence from the cases that is necessary to confirm or refute the theory. As a result, an inductive work tends to be more descriptive and look more carefully at how things work, rather than being overwhelmingly about why they are as they are.

In the earliest stages of the dissertation research, archival research and academic writings on urbanization, inter-governmental relations, and technopoles indicated that the federal government mostly promotes *virtual* innovation networks, while provincial governments mostly promote *anchored* innovation networks. The federal government prefers virtual networks, it was assumed, because these networks can be easily established in every part of the country (even economically less developed parts), thereby promoting geographically-inclusive economic growth. This assumption was given credence by certain observers who pointed out that federal innovation network programs extend to every region of Canada; in fact, some argue that Ottawa's concern for geographic inclusion or regional equality is one of the reasons why its innovation network policy has failed (Silcoff & O'Kane, 2023). Conversely, provincial governments prefer anchored networks because these networks serve the interests of local economic and political elites, many of whom have close ties to provincial leaders. These early

assumptions (or working hypotheses) operated as a ‘starting position’; they oriented the research project and provided a launching point for it. As the research unfolded, it became necessary to reconsider the relationships between governments and innovation networks. This process in which working hypotheses are disproven, refined, or developed into strong, empirically-grounded theories is consistent with inductive research (Scott & Garner, 2013, p96). The goal of the research is not simply to determine whether initial working hypotheses are accurate or truthful, but rather to modify, adapt, and improve the hypotheses as new facts emerge.

This dissertation is divided into eight chapters. The second chapter discusses the history and evolution of industrial policy around the world, with a particular focus on Canada. It shows how innovation network policy emerged in the 1980s and 1990s as a new form of industrial policy. The third chapter provides an overview of the academic literature on innovation networks, and on the public policies and programs that support them (both in Canada and abroad). The fourth chapter theorizes how geopolitical and geoeconomic forces may shape innovation network policy in Canada, drawing upon scholarly writings on federalism, multilevel governance, and international political economy. The fifth chapter discusses the governance and industrial policy histories of the federal government, Ontario government, and Alberta government. The sixth chapter catalogues the innovation network programs of the federal government, Ontario government, and Alberta government. The seventh chapter compares federal and provincial approaches to creating and promoting innovation networks, drawing upon both government documents and interviews. The eighth chapter summarizes the research findings and provides recommendations for future research.

Chapter 2: Global Industrial Policy History

The focus of this chapter is on ‘industrial policy’, a specific type of economic policy practiced by governments around the world. Industrial Policy has a long historical lineage dating back to the early nineteenth century. Broadly speaking, this type of economic policy seeks to cultivate and develop particular business enterprises, industries, or economic sectors that policymakers deem important to the economic life of a region or country (Johnson, 1982; Amsden, 1989; Evans, 1995; Chibber, 2003; Wade, 2004). In the words of one economist specializing in development economics, “industrial policy is the set of government measures—targeted at specific industries or firms—intended to support the development and upgrading of industrial output” (Di Maio, 2014, p550). The main theoretical assumption underlying industrial policy is that market forces alone cannot guarantee the development of important industries. As a result, the state must take direct action to nurture, protect, invigorate, and modernize such industries. Of course, successful industrial policy requires a range of different policy tools, including subsidies, tariffs, targeted tax credits, price controls, licenses, training programs, industrial oversight mechanisms, and public procurement measures. Some policy tools directly control and influence the investment and allocative decisions of economic actors, such as entrepreneurs, large corporations, and financial institutions. Others shelter domestic enterprises from foreign competition, regulate trans-border trade and investment, and encourage collaborative R&D and innovation. The aim of this chapter is, firstly, to examine the history and evolution of industrial policy around the world, and secondly, to consider how industrial policy has been practiced in Canada since Confederation. The chapter will show that industrial policy can be divided into two periods: a ‘classic’ period, which lasted from 1800 to 1980, and a ‘new’

period, which is ongoing. This review of industrial policy is necessary so we can better understand the context within which innovation network policy operates, as this form of policy is a subset of innovation policy, which is itself a subset of the ‘new industrial policy’.

Classic Industrial Policy

Between the years 1500 and 1800, European countries pursued a ‘mercantilist’ economic strategy that simultaneously advanced their commercial interests and imperialist ambitions (Nettels, 1952). Each country sought to maximize its own economic advantage and expand its own sphere of influence through a combination of warfare, colonization, restrictive trade practices, and the acquisition and hoarding of precious metals. England was particularly adept at this game, establishing many colonies in North America and the Caribbean and maintaining monopolistic trade relations with its colonial possessions. One of England’s primary economic goals during the era of mercantilism was to develop its domestic textile industry—which was in its infancy at the time—and to achieve dominance over the global textile market. To this end, the English government enacted various measures to support the nascent textile industry; for example, it protected the industry from foreign competition, mostly by imposing tariffs on textiles imported from abroad (Chang, 2003). These tariffs made foreign-produced textiles more expensive than domestically-produced textiles, thus allowing English textile manufacturers to maintain a competitive advantage. Going further, the government outright banned some foreign-produced textiles (like Indian silks and calicoes) from the domestic English market (Eacott, 2012). English textile manufacturers not only benefited from this protectionist trade regime, but also from a trans-Atlantic colonial system that guaranteed them access to overseas markets.

Classic industrial policy emerged in England at the end of the mercantilist period, as the country began to substitute human and animal labour for machines driven by water, steam, and

then electricity. As was the case in the era of mercantilism, protecting England's textile producers was a key feature of this new form of policy. This set a pattern for other industries and for the countries that industrialized after England. The United States relied on trade protectionism throughout the nineteenth century as part of its nation-building and economic development strategy. In an effort to develop the country's manufacturing sector, the American federal government levied tariffs not only on imported textiles, but also on imported iron goods, glass goods, distilled spirits, and many other manufactured goods (Merry, 2016; Caldentey, 2008). It also imposed tariffs on imported raw materials, such as hemp, flax, and wool. During and immediately after the American civil war, the federal government raised tariff rates, which increased the level of protection enjoyed by American manufacturers and planters while also generating additional revenue to cover war-related expenses and debts. Meanwhile, in Germany, the national government introduced protectionist trade policies with the strong support and encouragement of the Central Federation of German Industrialists (Webb, 1977; Lehmann, 2010). These policies aimed to protect three German industries, namely iron and steel production, cloth weaving and spinning, and agriculture.

Following in the footsteps of Europe and the United States, many countries in East Asia protected their domestic industries through tariffs in the 1960s and 1970s. For example, Taiwan imposed light tariffs (5% to 20%) on imported raw materials, and heavy tariffs (40% to 75%) on imported manufactured goods, including both finished consumer goods and industrial machinery and equipment (Wade, 2004, p127). It also established various non-tariff barriers to trade, the most important one being an elaborate system of import licensing. Under this system, enterprises in Taiwan (both domestically-owned and foreign-owned) required the approval of the national government—specifically the Board of Foreign Trade—to import certain capital goods (steel,

petrochemicals, machine tools, forklift trucks, etc). The purpose of this system was to minimize the importation of capital goods that could be produced domestically. In addition to limiting and regulating foreign trade, the national government seized control of all financial institutions, including banks, savings and loans associations, insurance companies, and even the stock exchange (Wade, 2004, p161-162). By controlling the entire financial system, the government was able to channel financial resources into ‘high-priority’ economic sectors—specifically export-intensive and technology-based sectors.

Like the government of Taiwan, the government of South Korea exercised tremendous control over the financial system in the 1960s and 1970s. Under the leadership of Park Chung-Hee, a shrewd dictator who rose to power in a military coup, the South Korean government “directly controlled the commercial banking sector, acted as a conduit for foreign loans and aid, and intervened extensively in the stock and security markets” (Pirie, 2007, p69). Throughout this period, South Korea’s government-controlled banks provided low-interest loans to certain ‘favoured’ enterprises, most of which were engaged in heavy manufacturing (steel, chemicals, ships, electronics). In return for this cheap credit, these enterprises were compelled to invest in high-risk (and sometimes unprofitable) industrial projects. Many were forced to export their products to foreign (including western) countries, despite having very little knowledge of international markets. Interestingly, most large enterprises in South Korea were organized into various industrial associations, which held regular meetings every year. These meetings were not only attended by the owners and managers of industrial enterprises, but also by government officials. During these meetings, participants developed industry-wide investment plans, established industry-wide production and export targets, and assessed overall industrial performance (Chibber, 2003, p80-81). By participating in these meetings, government officials

were able to learn about major industrial developments, hold enterprises accountable for reaching targets, and directly influence industrial activity.

In the 1960s and 1970s, large European and American corporations were searching for new investment opportunities around the world. Many sought to establish subsidiaries or branch plants in East Asia, which was experiencing rapid economic growth at the time. Although most countries in East Asia welcomed European and American subsidiaries, they often imposed restrictions on them and policed their behaviour. For example, they required subsidiaries to purchase equipment and raw materials from domestic suppliers, rather than from suppliers based in their home countries (Wade, 2004, p150-152). They also required them to transfer new technologies to domestic enterprises, sell shares to domestic investors, produce goods for export markets, and help promote industrial upgrading and modernization (Sharma, 1984; Wade, 2004). Sometimes these countries prohibited foreign investment in key economic sectors, and prevented subsidiaries from entering certain industries or producing certain goods. These rules and regulations ensured that subsidiaries contributed to the economic development of their host countries, and did not displace domestic enterprises or dominate domestic markets. It is important to note that East Asia was not the only region where countries monitored and regulated foreign-owned subsidiaries or controlled inflows of foreign direct investment (FDI). These practices were in fact quite widespread until the mid-1980s (Organization for Economic Cooperation and Development, 2003).

All of the policy measures discussed so far—the imposition of tariffs and import restrictions, the control of financial institutions, the monitoring of industrial performance, and the regulation of foreign-owned subsidiaries and FDI—fall under the category of ‘classic’ industrial policy. This form of industrial policy has four main characteristics. First, it relies (at least partly)

on coercion to achieve certain developmental goals. Economic actors are *compelled* to engage in certain activities or, alternatively, to abstain from certain activities. Second, it seeks to shape and influence economic activity at a micro or granular level. This was most evident in South Korea and India, where national governments established production targets and investment plans for various industries (Chibber, 2003). Third, it draws boundaries around national economies, and tightly controls the movement of goods and capital across these boundaries. National governments regulate trans-border trade and investment, thereby protecting domestic enterprises and industries from foreign competition. Fourth, it grants special privileges to domestically-owned enterprises. These enterprises may be provided subsidies and low-interest loans, offered exemptions from certain rules and restrictions, or given exclusive access to certain industries. As many scholars have shown, classic industrial policy reached its apogee in the 1960s and 1970s and then declined in the 1980s and 1990s as global economic and geopolitical conditions changed (Di Maio, 2014). Some scholars argue that this kind of industrial policy was mastered and perfected by the governments of East Asia, which possessed strong, cohesive, and well-organized bureaucracies capable of driving large-scale industrial transformation (Evans, 1995).

Globalization and the ‘New Industrial Policy’

Since the mid-1980s, international agreements on trade and investment have proliferated. These agreements ensure that goods and capital can move freely across national borders, unimpeded by tariffs, import quotas, capital controls, or arbitrary political interventions. Some of these agreements have been established by powerful international organizations, such as the World Trade Organization, the Organization for Economic Cooperation and Development, and the various governing bodies associated with the European Union (Organization for Economic Cooperation and Development, 2003). Between 1986 and 1994, the World Trade Organization

established three ‘capstone’ agreements—the Trade-Related Intellectual Property Agreement (TRIPS), the Trade-Related Investment Measures Agreement (TRIMS), and the General Agreement on Trade in Services (GATS)—all of which require countries to remove barriers to foreign trade and investment. Under these agreements, countries must respect the autonomy of all foreign-owned subsidiaries within their jurisdictions; they cannot require subsidiaries to purchase capital goods from domestic suppliers, transfer technologies to domestic enterprises, or produce goods for export markets (Wade, 2004, pxliv-xlv). Even more importantly, countries cannot exclude subsidiaries and foreign investors from certain industries and economic sectors. Similar restrictions are placed on countries by bilateral investment treaties (BITs), of which there are approximately 2,500 in existence today (Organization for Economic Cooperation and Development, 2023). A BIT is “an agreement between two countries regarding promotion and protection of investments made by investors from respective countries in each other’s territory” (United Nations Conference on Trade and Development, 2023). When two countries sign a BIT, they mutually agree not to block foreign investments or ‘discriminate against’ subsidiaries (Neumayer & Spess, 2005). Most BITs are signed between developing countries in the global south and developed countries in the global north.

With the emergence of multilateral trade and investment agreements and BITs, countries around the world have been forced to reject classic industrial policy. Under current international rules, it is impossible for countries to protect their domestic enterprises and industries from foreign competition, whether by imposing tariffs on imported goods or by imposing limits on incoming foreign investment. In addition, countries can no longer maintain systems of centralized industrial planning, coordination, and control. In East Asia, national governments have privatized financial institutions and opened up financial markets to foreign investors (Pirie,

2007, p76-104). They have also eliminated industrial regulations and oversight mechanisms, thus allowing private enterprises to make their own decisions about production, investment, and sales. It is important to note that the decline of classic industrial policy since the 1980s does not signal the death of *all* forms of industrial policy. This point was made by Joseph Wong, a Canada Research Chair in democracy and development, in his article titled *The Adaptive Developmental State in East Asia* (2004). Wong points out that, while countries are forbidden from using classic industrial policy tools (tariffs, import restrictions, etc), they “continue to experiment with industrial policies, R&D policies, social welfare reforms, and economic policy more generally in creative ways, albeit under many more constraints” (Wong, 2004, p357). In his view, national governments remain committed to developing and expanding important industries and economic sectors—such as biotechnology, consumer electronics, and transportation—through various policy interventions. Following Wong, many scholars have argued that a new kind of industrial policy has emerged over the past few decades (Wade, 2012; Lauridsen, 2016; Buzdugan & Tuselmann, 2018). Unlike the industrial policy of the past, this new industrial policy does not subordinate or subjugate economic actors, nor does it disrupt patterns of global trade and investment. In this sense, it is fully compatible with the modern, neoliberal world order.

In his article titled *Return of Industrial Policy?* (2012), Robert Wade describes the characteristics of the new industrial policy that has appeared since the 1980s. One of the main characteristics, he suggests, is a focus on creating ‘industrial networks’, which are defined as “networks linking government scientists, corporate engineers, entrepreneurs, venture capitalists, and university researchers aimed at fostering the growth of new firms and industries” (Wade, 2012, p230). In order to create such networks, governments fund collaborative research projects and research consortia, and provide specialized networking services to public, private, and

academic actors. The role of government, in this context, is simply to link or connect economic actors, *not* to control or discipline them. Michael Porter, a world-famous economist at Harvard Business School, presents a very similar vision of the new industrial policy in many of his writings (Porter, 1990; Porter, 2000). According to Porter, governments can promote industrial development by supporting and strengthening ‘industrial clusters’ or ‘innovation clusters’. As we saw in Chapter 3, an industrial/innovation cluster is a group of economically-productive organizations (industrial enterprises, universities, venture capital firms, research institutions) that are located in the same place and are tightly linked together in various ways. While governments cannot *create* clusters, they can help them grow and develop, usually by funding key organizations within them or building cluster-related infrastructure:

“Clusters often emerge and begin to grow naturally. Government policy had little to do with the beginning of Silicon Valley or the concentration of mechanical firms around Modena, Italy. Once a cluster begins to form, however, government at all levels can play a role in reinforcing it. Perhaps the most beneficial way is through investments to create specialized factors, such as university technical institutes, training centres, data banks, and specialized infrastructure” (Porter, 1990, p655).

In order for clusters to truly thrive, Porter argues, they must be completely open to foreign investment and hospitable to foreign-owned subsidiaries. Subsidiaries are vital for cluster development because they “enhance cluster externalities and productivity” and “contribute directly to local employment and investment” (Porter, 2000, p27). Governments can make clusters more attractive to foreign investors by, for example, building new industrial parks and other ‘megaprojects’ in the cities or regions where clusters are located.

Canadian Industrial Policy

Like the countries discussed in the previous sections, Canada has a long and rich history of industrial policymaking. Canada’s experience with industrial policy began in the 1870s, very soon after Confederation. At the time, most economic activity in Canada revolved around natural

resource extraction, canal and railway construction, and finance (Naylor, 1993). Although Canada had a manufacturing sector, it was quite small and insignificant compared to other sectors of the economy. Canada's political and business leaders believed that, in order for Canada to become a truly sovereign, unified, and strong nation, it needed to greatly develop its manufacturing capacities (Eden & Molot, 1993, p235). In their view, it was very important that Canada not rely on other countries for manufactured goods, such as iron and steel, electrical appliances, agricultural tools and machinery, horse carriages, and refined sugar. Canada's political and economic elite also believed that the federal government could (and should) use its legislative authority to accelerate the growth of the manufacturing sector. This is exactly what the federal government did throughout the late nineteenth century.

In 1872, the federal government introduced the Patent Act, which allowed Americans, the British, and other non-Canadians to obtain and hold patents in Canada (Williams, 1979). Some of these patents pertained to new consumer products, such as electrical appliances for households, while others pertained to new productive technologies, such as hydraulic machinery for large industrial factories. The Patent Act had a 'working clause', which required all patented products to be manufactured in Canada and all patented technologies to be employed in Canada within two years. In order to fulfill their obligations under the working clause, non-Canadian patent holders had to either establish their own production facilities in Canada or license their products and technologies to Canadian manufacturers. When John A. Macdonald was reelected as Prime Minister in 1878, the federal government launched the 'National Policy'—a national strategy of economic transformation and modernization. As part of this strategy, the federal government imposed heavy tariffs on imported manufactured goods, from small housewares to heavy machinery (Porritt, 1917). These tariffs not only protected Canadian manufacturers from foreign

competition, but also encouraged foreign manufacturers to establish branch plants or subsidiaries in Canada (as a means of bypassing the tariffs). Together, the Patent Act and the National Policy tariffs allowed Canada to absorb large amounts of foreign (especially American) technology and manufacturing capital. In the words of Glen Williams, “the working clause of the 1872 Patent Act and the 1879 National Policy tariffs worked hand-in-hand to transfer US technology and production to Canada” (Williams, 1979, p347).

In the decades following the introduction of the National Policy, Canada’s manufacturing sector grew enormously, as the number and size of manufacturing enterprises increased steadily year after year (Smardon, 2014, p59-63). Not only did the manufacturing sector grow in scale, but also increased greatly in technological prowess and sophistication; by the year 1910, many Canadian manufacturing enterprises were using the most advanced machinery available at the time, and had achieved almost the same level of productivity and output as their American counterparts. During World War II, Canada’s manufacturing sector experienced another round of rapid growth due to the demands of wartime preparation and mobilization. For the first time, the federal government exercised direct control over manufacturing enterprises, compelling them to produce munitions, military vehicles, and other military assets in large quantities (Nerbas, 2013). To further support the war effort, the federal government established many new crown corporations, including the Polymer Corporation, National Railways Munitions, and Turbo Research. Some of these corporations manufactured basic military supplies (firearms, ordinance, boats, aeroplanes), while others conducted advanced military research (Borins, 1982). A new federal body, the War Industries Control Board, was created to control the distribution and prices of raw materials, such as lumber, oil, and steel. By organizing and overseeing the mass production of military assets, the federal government not only helped defeat Nazi Germany, but

also accelerated the development of Canada's manufacturing capacities. With the conclusion of the war in 1945, the federal government swiftly ended its wartime industrial measures; it returned full managerial authority to the private sector, removed price controls, and privatized most of the new crown corporations.

The period between 1945 and 1970 is often viewed as the 'golden age' of global capitalism. Throughout this halcyon era, Canada's manufacturing sector continued to grow quickly. One of the most notable manufacturing industries in Canada at the time was the automobile industry, which produced hundreds of thousands of vehicles and employed tens of thousands of workers every year (Anastakis, 2005, p22-23). Like most other manufacturing industries, the automobile industry was dominated by American-owned branch plants. The federal government clearly recognized the importance of the automobile industry to Canada's economic prosperity. In an effort to bolster the industry, the federal government negotiated a landmark trade and investment deal—colloquially called the 'Auto Pact'—with the United States. Under this deal, American automobile companies—namely Ford, Chrysler, and General Motors—could export vehicles and auto parts to Canada without being subject to tariffs. The Auto Pact was not simply a 'free trade deal', however, because it required American auto companies to create additional branch plants and expand existing branch plants in Canada (Anastakis, 2005, p124-125).

The same year the federal government negotiated the Auto Pact (1965), it introduced two programs designed to increase the level of R&D and innovation in the Canadian economy: the Industrial Research and Development Incentives Act (IRDIA) and the Program for the Advancement of Industrial Technology (PAIT). These two programs provided grants and tax credits to Canadian enterprises—both domestically-owned and foreign-owned—that invested in

new products, production methods, and productive technologies (Smardon, 2014, p167-171). In order to qualify for these programs, enterprises had to conduct R&D projects of great economic value and benefit to Canada. Foreign-owned enterprises were less likely to qualify for these programs than domestically-owned enterprises for two reasons. First, most foreign-owned enterprises in Canada were subject to ‘export restrictions’—in other words, they were not allowed to sell their products outside of Canada. These restrictions were imposed on them by their parent companies, not by any governments. If foreign-owned enterprises developed new products, they could only sell these products to Canadian consumers. In contrast, domestically-owned enterprises could sell new products to both Canadian and foreign consumers, thus generating greater economic value for Canada (Smardon, 2014, p172). Second, foreign-owned enterprises often shared the results of their R&D projects with their parent companies located in other countries. The federal government worried that, if these enterprises transferred new product designs, technical knowledge, and other R&D outputs to their parent companies, then Canada’s economic competitiveness would suffer. In a sense, the IRDIA and PAIT programs discriminated against foreign-owned enterprises—a common feature of classic industrial policy. Let us recall that national governments in East Asia also subjected foreign-owned enterprises to differential and sometimes ‘unfair’ treatment in the 1960s and 1970s.

By the time Pierre Trudeau was elected Prime Minister in 1968, a very large proportion of the Canadian economy was under foreign ownership. According to statistics from this period, approximately 65% of Canada’s natural resource enterprises and 60% of its manufacturing enterprises were owned by foreign investors and corporations (Levitt, 2002 [1970], p119; Smardon, 2014, p209). The federal government was partly responsible for this situation; over the past hundred years, the federal government enacted various policies—including the Patent Act of

1872, the National Policy tariffs of 1879, and the Auto Pact of 1965—that encouraged foreign corporations (mostly from the United States) to establish subsidiaries and branch plants in Canada. While these policies expedited Canada’s industrial development, they also made the country vulnerable to foreign economic domination. With the election of Pierre Trudeau, foreign ownership became a topic of political debate and public discourse. Across Canada, people began to view foreign ownership as a threat to Canada’s ‘economic sovereignty’ and even its territorial integrity. Many policymakers at the federal level, especially those in the progressive wings of the Liberal Party and New Democratic Party, fully embraced ‘economic nationalism’—the idea that Canada’s industries and economic assets should be primarily owned and controlled by Canadians, not by foreign investors and multinational corporations (Azzi, 1999, p167-185). Trudeau was not as nationalistic as many progressive Liberals and New Democrats, such as Walter Gordon, Herb Gray, and Mel Watkins. Even so, he was fairly concerned about the high level of foreign ownership in the Canadian economy, and was prepared to take meaningful action on this issue. As we will see in Chapter 4, this concern dovetailed with concerns about regional economic inequality and its impact on national unity.

During his first term in office, Trudeau established the Foreign Investment Review Agency (FIRA), a new federal agency dedicated to monitoring and controlling the flow of foreign direct investment (FDI) into Canada (Glover, 1974). Under its founding charter, FIRA had the power to deny foreign multinational corporations entry into Canada. This could be done by preventing these corporations from creating new subsidiaries in Canada or from taking over Canadian-owned enterprises. Trudeau also established many new crown corporations, most notably PetroCan and the Canada Development Corporation (CDC). PetroCan was an oil and gas company that searched for new oil reservoirs across Canada, extracted and refined oil, and sold

gasoline to Canadian consumers through its vast network of petrol stations. During its first few years in existence, PetroCan purchased a number of foreign-owned oil and gas companies operating in Canada, thus bringing these companies under Canadian ownership and control (Sweeny, 2010, p116-125). The CDC, on the other hand, was primarily a financial institution; it provided loans and equity capital to Canadian-owned enterprises, especially to those in key industries (oil and gas, petrochemicals, mining, healthcare, and transportation) (Heinberg, 1980). Occasionally, the CDC attempted to nationalize foreign-owned enterprises by purchasing their shares and other assets. It should also be noted that, under Trudeau's leadership, the IRDIA and PAIT programs continued to discriminate against foreign-owned enterprises; in fact, they became even more discriminatory (Smardon, 2014, p199).

Trudeau's efforts to reduce the level of foreign ownership in the Canadian economy were mirrored by provincial leaders across Canada. Peter Lougheed, the Progressive Conservative premier of Alberta, tried to wrest economic power away from foreign multinational corporations throughout the 1970s (McQuaig, 2019, p176). At the time, multinational corporations owned and controlled the majority of Alberta's oil and gas industry, which was (and remains) the largest and most lucrative industry in the province. In an effort to assert domestic control over the industry, Lougheed forced foreign-owned oil and gas companies to pay heavy royalties to the provincial government. He also established the Alberta Energy Company (AEC), a semi-public oil and gas company that was half-owned by the provincial government and half-owned by private investors living in Alberta (McQuaig, 2019, p178). Soon after its creation, the AEC was granted control over many valuable, oil-rich lands in the province, including the Suffield and Primrose oil reserves (Sweeny, 2010, p119). Throughout its twenty-nine years in operation, the AEC extracted both oil and natural gas across the province, and invested in petrochemical production. It

distributed its profits among Alberta residents, who could purchase AEC shares at very low prices.

Between 1960 and 1985, the province of Quebec was governed by three different political parties: the Liberal Party, the Union Nationale, and the Parti Québécois. Although these three parties had different views with regard to Quebec sovereignty and language policy, they all vigorously supported economic nationalism. It should be noted that economic nationalism had a different meaning in Quebec than it did in other parts of Canada. For Quebec's economic and political elite, economic nationalism meant the elevation of French-Canadian economic power within Quebec, and the simultaneous diminution of English-Canadian economic power. In practical terms, this required strengthening and expanding French-Canadian-owned enterprises, and transferring economic assets from English-Canadian hands to French-Canadian hands. In the early 1960s, the provincial government of Quebec expropriated a number of private electric utility companies, all of which were owned and managed by English-Canadians. It then combined these companies to form Hydro-Quebec, a public utility company fully managed by French-speaking Quebecois (Fournier, 1978). The government also established a number of public financial institutions, most notably the Société générale de financement (SGF) and the Caisse de dépôt et placement du Québec. These institutions invested almost exclusively in French-owned enterprises, such as Bombardier, Provigo, and Marine Industries (McRoberts, 2000, p174-175). Although these nationalist industrial policies produced mixed results, they continued far into the 1970s. Thus, while Pierre Trudeau was resisting economic domination by foreign multinational corporations, Quebec's leaders were resisting economic domination by English-Canadians (using somewhat similar policy tools).

Pierre Trudeau and his Liberal Party lost the 1979 federal election, despite receiving the majority of the popular vote. Upon its electoral defeat, the party underwent major internal changes; many left-wing members of the party rose to positions of prominence, while many right-wing members resigned or were marginalized. As the party tilted increasingly leftward ideologically, it became even more dedicated to the cause of economic nationalism (Smardon, 2014, p263-264). During its campaign for reelection in 1980, the Liberal Party promised to reinforce and build upon the nationalist industrial policies of the 1970s. Pierre Trudeau, who remained the leader of the party, was willing to experiment with even more radical policy measures to ‘Canadianize’ the economy. When Trudeau returned to power in 1980, he appointed Herb Gray, a respected Liberal operative and leading Canadian nationalist, as the new Minister of Industry. While serving in this role, Gray was directly responsible for managing and overseeing FIRA. Under Gray’s leadership, FIRA blocked more incoming foreign investment than ever before:

“By appointing Herb Gray, a well-known nationalist, as industry minister in 1980, Pierre Trudeau ensured a more vigorous review process for foreign companies wishing to invest in Canada. Since its creation in 1974, FIRA had traditionally refused a mere 7 percent of applications for investment or acquisition. Under Gray, the refusal rate rose to 13 percent. In addition, the review process was conducted much more meticulously, with only fifty-four of an average of sixty-three applications arriving each month being processed. This close perusal of investment applications created a backlog of 400 cases and slowed the review process” (Jenkins, 1986, p152).

In addition to strengthening FIRA, Trudeau introduced the National Energy Program (NEP), arguably the most infamous industrial policy in Canadian history. The NEP targeted Canada’s oil and gas industry, but had profound implications for the entire Canadian economy. It was extremely polarizing, angering large swaths of Canada’s western population and inciting a major conflict between the provincial government of Alberta and the federal government.

One of the main objectives of the NEP was to increase the level of Canadian ownership over the oil and gas industry, which was dominated by foreign multinational corporations. In a policy document accompanying the announcement of the NEP, the federal government recognized that multinational corporations played an important role in Canada's oil and gas industry by contributing valuable financial, technological, and logistical resources. It argued, however, that these corporations must now step aside, allowing Canadian-owned enterprises (both public and private) to assume more prominent positions in the industry:

“The Canadian oil and gas industry has historically benefitted to a substantial degree from the availability of foreign risk capital invested by the major multinational oil companies. These companies also brought important technical skills to this sector. Continuing foreign inputs will be of value to Canada, and those firms demonstrating responsiveness to Canadian interests and objectives will continue to play a major role in the energy sector. At the same time, greater Canadian ownership of the oil and gas industry in this country is a clear objective of the Government's policies. It is time that more of the considerable increase in the value of Canada's petroleum reserves, occasioned by international events, accrued to Canadians. On the technical side, Canada has a sophisticated talent base. Furthermore, many of the challenges of future energy developments are somewhat unique to Canada—oil sands development and operations in ice-infested frontier waters, for example. Technical advances in these and other areas will have to be paid for by the value of the Canadian resources involved, regardless of which companies undertake the work, and it is only fair that the benefits of the activity and know-how associated with such efforts accrue to Canadians” (Energy, Mines, and Resources Canada, 1980, p48-49).

In 1980, the year that the NEP was introduced, only 27% of Canada's oil and gas industry was controlled by Canadians. The goal of the NEP was to achieve 50% Canadian control by the year 1990. In order to accomplish this goal, the federal government provided subsidies to Canadian-owned oil and gas companies, allowing these companies to expand their oil exploration activities and to compete effectively with their foreign-owned rivals (Jenkins, 1986, p147). Canadian companies received the highest subsidies if they engaged in oil exploration and extraction in the ‘Canada lands’—that is, parts of Canada that exist outside of provincial boundaries (including

parts of the Atlantic Ocean). The government also guaranteed PetroCan a minimum 25% ownership stake in all offshore oil sites (Energy, Mines, and Resources Canada, 1980, p47).

The NEP not only sought to increase Canadian ownership over the oil and gas industry, but also to generate additional revenue for the federal government, mostly by imposing new federal taxes on oil and gas companies across Canada. Two new taxes were introduced through the NEP: the Petroleum and Gas Revenue Tax (PGRT) and the Natural Gas and Gas Liquids Tax (NGGLT) (Energy, Mines, and Resources Canada, 1980, p37). As these new taxes were being phased in, world oil prices were falling, causing Canada's oil and gas industry to enter into recession. Between 1980 and 1984, a number of large oil and gas companies in Canada lost considerable market value, and were forced to scale back their oil exploration, drilling, and refining activities (Jenkins, 1986, p148). As these companies faced mounting economic hardships, there was growing political unrest in Alberta and Saskatchewan, where most oil and gas activity was concentrated (Leslie, 1987). Business and political leaders in these two western provinces blamed the NEP and its attendant taxes for the rapid decline of the oil and gas industry. In a highly-publicized act of protest against the NEP, Peter Lougheed threatened to reduce the amount of oil shipped from Alberta to central Canada (James & Michelin, 1989). He also challenged the constitutionality of the NEP in provincial and national courts. Faced with strong opposition from western Canada, Trudeau decided to reduce the stringency of the NEP while preserving its basic elements (Jenkins, 1986, p149-150; Sweeny, 2010, p123). He subsequently resigned from office.

One of the most consequential actions taken by Pierre Trudeau during his second term in office, aside from enacting the NEP, was assembling the Royal Commission on the Economic Union and Development Prospects of Canada, commonly referred to as the Macdonald

Commission. The Macdonald Commission was a group of thirteen individuals—mostly economists, business leaders, and current and former policymakers—tasked with investigating the current state of the Canadian economy, and with recommending new economic or industrial policies for Canada (Inwood, 2005, p80-80). As part of its investigation, the Commission travelled to various towns and cities across Canada, speaking to business lobbyists, social movement representatives, concerned citizens, and other actors from different sectors of Canadian society. The Commission also collected and read over one-thousand written statements from industry associations, community organizations, and labour unions. After conducting its nationwide investigation, the Commission wrote a lengthy report presenting its findings and recommendations. The report was published in 1985, one year after Pierre Trudeau had resigned from office. In its report, the Commission recommended that Canada’s federal and provincial governments adopt a more liberal, market-based approach to economic policy. Canadian governments were advised by the Commission to privatize crown corporations, deregulate industries, eliminate nationalist industrial policies, and open Canadian markets to foreign goods and investment. Most importantly, the Commission argued that Canada should enter into a bilateral free-trade agreement with the United States (Inwood, 2005, p92-93). Such an agreement, the Commission suggested, would increase the competitive pressures faced by Canadian enterprises, thus forcing them to become more innovative and flexible.

In the early 1980s, there was a major shift in economic thinking among Canada’s political and economic elite. Political and business leaders across the country turned away from economic nationalism and rejected top-down, state-driven industrial strategies. Instead, they embraced free-market reforms, fiscal austerity, trade liberalization, and economic integration with the United States (Eden & Molot, 1993, p242). Even before the release of the Macdonald

Commission report in 1985, neoliberal economic ideas gained many adherents within the corridors of power. One of the most notable adherents was Brian Mulroney, who became Prime Minister in 1984. Very soon after coming to power, Mulroney terminated the NEP, replacing it with the industry-friendly 'Western Accord' and 'Atlantic Accord'. With the NEP eliminated, foreign multinational corporations were able to maintain almost full control over Canada's oil and gas industry. One year later, Mulroney transformed FIRA into a new agency called Investment Canada (Jenkins, 1986, p153). Like its predecessor organization, Investment Canada had the power to block or limit incoming FDI from the United States, Europe, and elsewhere (Arnett, 1985). Under Mulroney's leadership, however, the agency hardly exercised this power, choosing instead to draw as much FDI into Canada as possible (Stanford, 2010). Following the advice of the Macdonald Commission, Mulroney privatized a number of federal crown corporations, including the Canada Development Corporation and PetroCan. Even more importantly, he signed Canada onto two free-trade agreements with the United States and Mexico. These two agreements—the Canada-US Free Trade Agreement (CUFTA) and the North American Free Trade Agreement (NAFTA)—required Canada to rescind the various tariffs that had protected its domestic manufacturing industries since the late nineteenth century (Hart, 2007, p68). They also required Canada to abandon any policies or regulations that hurt or disadvantage American-owned subsidiaries operating in Canada. With the introduction of these two agreements, trade and investment flows between Canada and the United States continued to grow and deepen. There is some debate among economists and scholars, however, as to whether these agreements were directly responsible for the increase in trans-border trade and investment (Gould, 1998; Hart, 2007).

The 1980s and 1990s was a time of global economic liberalization, as trade and investment was gradually emancipated from national governmental controls. Countries around the world embraced multilateral and bilateral trade and investment agreements, forcing them to eliminate barriers to international trade and investment (Organization for Economic Cooperation and Development, 2003). Canada was not immune to these liberalizing forces; as we just saw, Canada signed onto CUFTA and NAFTA during the Mulroney years. Around the same time, the country signed onto the three capstone agreements of the World Trade Organization, namely TRIPS, TRIMS, and GATS. Under these various agreements, Canada's federal and provincial governments could no longer protect domestic industries from foreign competition, provide preferential treatment to Canadian-owned enterprises, or resist foreign ownership over key economic sectors (Sharaput, 2010, p114-115). Unable to carry out nationalist industrial policies, these governments pursued a new industrial strategy, one that was better suited to a world of free trade and economic globalization. They began forging connections between private enterprises, universities, public research institutions, and other innovative organizations in an effort to stimulate collaborative R&D and innovation. In order to connect these organizations, they created and funded both virtual and anchored innovation networks across Canada (Bell, 1996; Wolfe & Gertler, 2001; Niosi, 2001; Fisher, Atkinson-Grosjean & House, 2001). This new industrial strategy allowed these governments to support the growth of key Canadian industries without violating multilateral trade and investment agreements or interfering with global movements of goods and capital.

Today, there are government-sponsored innovation networks in practically every city, province, and region of Canada. These networks are composed of many diverse organizations from the private, public, and nonprofit sectors. Many of them include not just Canadian-owned

enterprises, but also large multinational corporations and their subsidiaries. For example, the five ‘superclusters’ created by the federal government in 2017 include a number of global corporate titans, such as Microsoft, Deloitte, and GE Healthcare (a subsidiary of General Electric) (Canada’s Ocean Supercluster, 2021, p13; Canada’s Digital Supercluster, 2022, p62-64). Similarly, the MaRS Centre, an anchored innovation network located in downtown Toronto, contains a laboratory owned and operated by JLABS, a subsidiary of Johnson & Johnson Corporation. Multinational corporations are often invited to participate in innovation networks because they possess extensive financial, technical, and marketing resources, and have easy access to global capital and consumer markets. One could argue that federal and provincial innovation network programs are partly designed to encourage multinational corporations to conduct more R&D in Canada, collaborate more with Canadian-owned enterprises, and contribute more to Canada’s national system of innovation. This argument was made by a federal program officer interviewed for this project:

“If you look at the amount of money that global or multinational corporations actually invest in R&D in Canada, it’s very little. These corporations have billions to trillions of dollars sitting on the sidelines, not invested in the Canadian economy. This has been a chronic problem—it doesn’t matter what flag is flying on parliament hill or what party is in power. Canada has always been viewed [by multinational corporations] as a place to manufacture and sell products, not to [conduct research and development]. I suspect that the federal government’s innovation network programs—whether it’s the Innovation Supercluster program, FedDev, or whatever—the idea is to use that federal stimulus to get multinational corporations to actually invest more of their available resources into research and development in Canada, instead of just sucking all the revenue out of Canada” (Program Officer 2).

Conclusion

This chapter differentiated between two forms of industrial policy: ‘classic industrial policy’ and ‘new industrial policy’. Classic industrial policy was predominant throughout the late-modern (1800-1945) period of history, as well as much of the contemporary period (1945-

Present). New industrial policy has been dominant since the 1980s. Both forms of industrial policy seek to develop, expand, and upgrade important industries and economic sectors. They do so using very different instruments and methods, however. Classic industrial policy regulates and restricts trans-border trade and investment, monitors and disciplines private business enterprises, and controls the flow of financial resources. In contrast, new industrial policy establishes connections between innovative actors (entrepreneurs, academics, researchers) and innovative organizations (private enterprises, universities, research institutions, financial institutions). This type of industrial policy also invests in scientific research, technical education, and industrial infrastructure (including science parks, innovation hubs, and technology incubators). Two important distinctions can be made between classic and new industrial policy. First, new industrial policy is more *laissez-faire* than classic industrial policy, because it does not subject private enterprises to direct surveillance and control, nor does it create barriers to foreign trade and investment. Second, classic industrial policy is more *nationalistic* than new industrial policy, because it prioritizes the growth of nationally-owned or domestically-owned enterprises (particularly those in key industries and economic sectors). To protect and nurture nationally-owned enterprises, classic industrial policy often excludes, marginalizes, and circumscribes the activities of foreign-owned enterprises and foreign investors. Conversely, new industrial policy treats domestic and foreign enterprises/investors equally.

Between 1867 and 1984, Canada practiced its own unique and idiosyncratic brand of classic industrial policy. During the period of Confederation and early nation-building (1867-1880), Canada's federal government launched an ambitious strategy to grow Canada's manufacturing sector, which was mostly based in Ontario and Quebec. As part of this strategy, the federal government imposed heavy tariffs on imported manufactured goods, most of which

were from Britain and the United States. These tariffs were expanded in the following decades, allowing Canadian manufacturers to maintain high levels of profitability. While the federal government erected barriers to foreign trade, it did not erect barriers to foreign investment. In fact, it *encouraged* foreign multinational corporations (mostly from the United States) to create subsidiaries and branch plants in Canada throughout the late nineteenth century and most of the twentieth century. It was not until the late 1960s, with the election of Pierre Trudeau, that the federal government enacted measures to reduce inflows of foreign investment into Canada. Under Trudeau, the federal government prevented some multinational corporations from creating subsidiaries in Canada and from taking over Canadian-owned enterprises. FIRA, CDC, PetroCan, and other organizations were created by the federal government to nationalize foreign-owned enterprises and increase the level of Canadian ownership over key industries, including oil and gas, petrochemicals, mining, and transportation. The Trudeau period (1969-1984) represented the high watermark of economic nationalism and classic industrial policy in Canada. Even during this period, however, Canada's federal and provincial governments did not engage in central industrial planning and coordination. Unlike the governments of East Asia, Canadian governments never seized control of financial institutions, closely monitored industrial activity (except very briefly during World War II), established production targets for key industries, or pressured private enterprises to make high-risk investments.

The election of Brian Mulroney in 1984 signalled a paradigm shift in Canadian industrial policy. Mulroney eliminated practically all federal programs that promoted Canadian ownership over key industries and provided special support to Canadian-owned enterprises. Most importantly, he signed Canada onto NAFTA, which prohibited Canada from imposing tariffs on American goods and from discriminating against American-owned subsidiaries. Mulroney's

successor, Jean Chretien, signed Canada onto many other multilateral trade and investment agreements, greatly limiting Canada's ability to regulate foreign trade, limit incoming foreign investment, and police foreign-owned subsidiaries. These agreements made classic industrial policy untenable, forcing Canada to adopt a new form of industrial policy (the so-called 'new industrial policy'). Canada's federal and provincial governments began creating and funding innovation networks through various programs, including the Networks of Centres of Excellence program, the Ontario Centres of Excellence program, and the Genome Canada program. Many of these programs are described in detail in Chapter 6.

Chapter 3: Innovation Networks and Innovation Policy

The global economy underwent radical changes in the 1980s and 1990s. One of the changes that occurred was that innovation became a collaborative process, as private firms, public research institutions, and universities began working together to create new products and production processes. At the same time, governments all over the world started actively promoting collaborative innovation by funding research consortia, building science parks and technology incubators, and encouraging the geographic agglomeration of industries and educational institutions. These developments changed how some economists, economic geographers, and public policy experts view innovation. It became apparent to these scholars that many innovation theories of the past, which reflected the methodological individualism of neoclassical economics, were extremely limited and inadequate. They realized that new products and technologies were being created by ‘innovation networks’ rather than solitary actors or organizations, and that these networks were often supported by government policies and programs. Over time, many academic books and articles were written on the emergence and development of innovation networks, and on the role of government in their creation and expansion.

The purpose of this chapter is to review the academic literature on innovation networks, and to describe the different facets of innovation network theory. The chapter is divided into five sections. The first section looks briefly at the innovation theory of Joseph Schumpeter, an Austrian-Czech economist who was considered an intellectual authority on innovation throughout much of the twentieth century. It is argued that, despite its enormous influence, Schumpeter’s theory presented a simplistic view of the innovative process, one that over-

emphasized the role of individuals and downplayed the role of institutions and collective action. The second section looks at books and articles by more recent innovation scholars, such as Christopher Freeman (1987), Bengt-Åke Lundvall (1988), and Richard Nelson (1990). These scholarly works laid the foundations for innovation network theory; they identified the different organizations that often participate in innovation networks, and examined the knowledge flows and learning dynamics that unfold between these organizations. Some works considered the geographic dimension of innovation networks, observing how networked organizations ‘cluster’ in particular cities and regions. The third section looks at scholarly writings on innovation network programs—that is, government programs designed to create and strengthen innovation networks. The fourth section also surveys the literature on innovation network programs, but with a particular focus on Canadian scholars. Finally, the fifth section explores the broad discourse around innovation policy, both in Canada and around the world. It also situates innovation network programs within this discourse.

Joseph Schumpeter and the Entrepreneur

Born in 1883 in the Czech city of Triesch, Joseph Schumpeter was a prodigious economist who, from a very young age, made a large impact on the field of economic science. Although Schumpeter is not well-known outside of academic circles, he should be regarded as one of the greatest economists of the twentieth-century, as he was the first economist to place innovation at the centre of economic analysis. In his book *The Theory of Economic Development* (1983 [1934]), Schumpeter argued that capitalism is an ever-changing and ever-evolving system, continually shifting from one state of market equilibrium to another. The driving force of change within capitalism is *innovation*, defined as the creation of new products, the improvement of existing products, and the creation of new methods of production. Schumpeter referred to people

who carry out innovations as ‘entrepreneurs’, and argued that such people come from all walks of life. While many entrepreneurs are the owners of business enterprises, some are managers, employees, financiers, promoters, and independent inventors. Schumpeter emphasized that entrepreneurs do not constitute a social class in the Marxian sense—they have no common history, culture, or objective material interest.

In order to become an entrepreneur, Schumpeter argued, a person must possess certain characteristics. First, they must have the *intelligence* to identify new technical possibilities and new ways to satisfy social and material needs. Second, they must have the *courage* to embark on innovative projects, despite the risk of suffering personal financial ruin and social disrepute. Third, they must have the *willpower* to overcome self-doubt and “fixed habits of thinking” (Schumpeter, 1983 [1934] p86). In any given society, these characteristics are very rare, possessed by only a small fraction of the total population. Entrepreneurs are truly exceptional individuals who are able to transform the economy through their ingenuity and sheer force of will, amassing giant personal fortunes in the process. They are ‘heroic’ and ‘romantic’ figures driven by a desire to change the world, gain social esteem, and establish their own ‘private kingdoms’. In Schumpeter’s theoretical framework, entrepreneurs carry out innovations in complete isolation, without any guidance, mentorship, or technical and logistical support from other actors in society. The only support that entrepreneurs receive is from financiers, who provide them with the capital needed to purchase land, labour, and equipment.

Schumpeter deserves praise for recognizing the central role of innovation in economic affairs, and for incorporating innovation into the neoclassical economic framework. He also deserves criticism, however, for describing the innovative process in a simple and unrealistic way. In *The Theory of Economic Development*, Schumpeter suggests that certain people are born

with innate entrepreneurial abilities, and that these abilities cannot be acquired through schooling or practice. In reality, entrepreneurship can be fostered by social, cultural, and political institutions—indeed, one of the main functions of business schools and technology incubators in today’s economy is to help people become entrepreneurs. In the same book, Schumpeter says that innovations are carried out by solitary individuals possessing unique intelligence, courage, and willpower. In reality, innovations are often carried out by groups of actors working together, such as business owners, scientists, engineers, and researchers. This is especially true in the modern high-tech economy, where collaboration has become essential for the creation, testing, and marketing of new consumer products and productive technologies. While Schumpeter’s theory of innovation may be applicable to the economy of the Gilded Age, it is not applicable to the modern economy. This point was made by Richard Nelson in his article titled *Capitalism as an Engine of Progress* (1990):

“The limitations of the simple Schumpeterian formulation come into view when one studies the advent and evolution of modern technologies like airframes and engines, computers, semiconductors, synthetic materials, or pharmaceuticals. The stark Schumpeterian model fails to recognize the variegated nature of modern technological knowledge and the complex and often subtle relationships between technology and science that are essential parts of these histories...Once one sees the differentiated nature of technology and its overlap with science, the wide range of institutions that can be and have been involved in the scientific and technological enterprise, and the major supporting and shaping role played by government, it becomes clear that the simple Schumpeterian sketch misses large parts of the modern capitalist engine, and mis-specifies others” (Nelson, 1990, p196-198).

In order to understand how innovation happens in the modern economy, one must recognize that technological change and development is now a collaborative process involving a multitude of actors and organizations. Going further, one must study the inner workings and dynamics of innovation networks and clusters. This is exactly what scholars started doing in the 1980s.

Innovation Network Theory Literature

One of the most notable innovation scholars in the late twentieth century was Christopher Freeman, a renowned British economist who worked closely with the Organization for Economic Cooperation and Development. Although Freeman was heavily influenced by the ideas of Joseph Schumpeter (and helped establish the ‘neo-Schumpeterian’ school of economic thought), he rejected Schumpeter’s simple conception of the innovative process. He understood that innovation is a highly complex process, one requiring interaction and cooperation between different actors within an appropriate institutional setting. In 1987, Freeman wrote a book titled *Technology Policy and Economic Performance: Lessons From Japan*, which tried to explain Japan’s rapid economic growth in the 1970s and early 1980s. In the beginning of the book, Freeman argued that Japan was able to achieve extraordinarily high levels of growth because its firms were highly innovative, especially those in the automobile, consumer electronics, and optics-photonics industries. Using global economic data, Freeman showed how Japanese firms (on average) generated more patents and spent more money on research and development than firms in Britain, France, West Germany, and other industrialized countries (Freeman, 1987, p20). There were three reasons why Japanese firms were such strong innovators, Freeman believed. First, Japanese firms adopted a ‘horizontal’ organizational structure, in which the R&D, production, and marketing departments work closely together and share information openly. Second, Japanese firms reverse-engineered products from Europe and the United States for many years, allowing them to gain mastery over the most advanced global technologies and to view product design and process design “in an integrated way” (Freeman, 1987, p40). Third, in many Japanese industries, there were very close links between firms that produce finished consumer goods and firms that supply the equipment, components, and raw materials used in the production of such goods. In the automobile industry, for example, firms that produce cars and

trucks were strongly connected to firms that supply robots and other assembly line equipment. By engaging in intimate dialogue and collaboration with their suppliers, Japanese firms were able to generate a stream of innovative products and penetrate global markets.

In his analysis of the Japanese economy, Christopher Freeman highlighted the presence of strong inter-firm linkages, claiming that these linkages spur innovation and thus economic growth. He did not explain how strong linkages are established, however, or how firms that are closely connected exchange information, personnel, and other resources. One year after the publication of Freeman's book, a Swedish economist named Bengt-Åke Lundvall wrote an essay titled *Innovation as an Interactive Process* (1988), which provided the first real theorization of inter-firm linkages and collaboration. The essay distinguished between two different types of firm: *producer firms* and *user firms*. Producer firms develop and manufacture synthetic materials, components, machinery, information technology, and other 'productive inputs' that are needed to produce finished goods. User firms purchase these inputs from producer firms, and then use them to produce finished consumer goods. Whenever user firms seek to carry out innovations—that is, whenever they seek to produce new consumer goods—they must purchase new productive inputs from producer firms. In many industries, user firms actually work with producer firms to design new inputs before purchasing them. For example, whenever automobile firms seek to produce new electric vehicles, they work with auto parts suppliers and mechanical engineering firms to design new electric batteries, motors, and electric power control units. Lundvall described the different stages of user-producer collaboration, and argued that such collaboration can only be successful if there is mutual trust between user and producer firms (Lundvall, 1988, p353). Successful collaboration also depends on the effective flow of information between firms; user and producer firms must be able to exchange information that is highly technical and constantly

changing, which requires that they establish special ‘information channels’ and ‘information codes’ (Lundvall, 1988, p354).

Lundvall’s essay was a seminal work in the field of innovation studies, as it represented the first attempt to understand inter-firm collaboration from a theoretical perspective. This work was somewhat limited in scope, however, because it only looked at collaboration between firms that produce inputs and firms that use those inputs. As Richard Nelson (1990) later showed, collaboration not only occurs between user and producer firms, but also between rival firms that produce similar goods and compete in the same market. For example, two pharmaceutical companies that produce pain medication may engage in joint innovative ventures, pooling their resources to test new molecular compounds, conduct drug trials, or carry out market research. In many high-tech industries, Nelson says, scientists and engineers employed by rival firms often meet each other at workshops, conferences, and industry association meetings, where they openly share their knowledge and experiences, plan collaborative projects, and speculate about future technological developments (Nelson, 1990, p203-204). It is not uncommon for engineers in rival firms to help each other diagnose technical problems and develop solutions to them. Not only do firms interact and collaborate with their rivals, but they also work closely with universities and public research institutions. Nelson explains how many firms in the pharmaceutical, agriculture, chemical, and electronics industries fund research being conducted in universities in order to gain early access to new scientific knowledge. Some firms encourage their scientists to provide direct assistance to universities, whether by training graduate students, overseeing graduate-level research projects, or guiding the development of new curricula (Nelson, 1990, p208). By maintaining close ties to universities, firms can keep abreast of emerging technologies and recruit new talent.

In 1990, a Harvard professor named Michael Porter gained worldwide recognition and acclaim when he published his book *The Competitive Advantage of Nations*, which (as the title suggests) sought to identify the conditions that make national economies competitive. One of the major claims of the book was that, in most advanced industrialized countries, firms, universities, research institutions, training centres, and other innovative organizations are geographically concentrated in particular cities and regions (Porter, 1990, p154). In the United States, for instance, a large number of universities, technical institutes, and computer hardware and software firms are located in the state of Massachusetts. By co-locating or clustering together, Porter argued, innovative organizations can easily share information about emerging technologies and scientific breakthroughs, and develop strong and enduring relationships that drive innovation. After the appearance of Porter's book, scholars began using the term 'innovation cluster' to describe any group of innovative organizations that are located in the same place, and that regularly engage in interactive learning and collaborative innovation. One innovation cluster that received considerable scholarly attention was in Silicon Valley, a region circling the city of San Jose, California. The Silicon Valley cluster was described quite vividly by AnnaLee Saxenian, a social network specialist and professor at UC Berkeley, in her influential book *Regional Advantage*:

“Silicon Valley has a regional network-based industrial system that promotes collective learning and flexible adjustment among specialist producers of a complex of related technologies. The region's dense social networks and open labour markets encourage experimentation and entrepreneurship. Companies compete intensely while at the same time learning from one another about changing markets and technologies through informal communication and collaborative practices; and loosely linked team structures encourage horizontal communication among firm divisions and with outside suppliers and customers” (Saxenian, 1996, p2).

In Silicon Valley, Saxenian explained, engineers, product designers, and researchers from different organizations frequently meet each other at bars, restaurants, and other social settings to

bond and socialize. As these innovative actors casually rub shoulders, they not only discuss personal matters, but also engage in conversation about technical feats, challenges, and opportunities (Saxenian, 1996, p33). When innovative actors engage in regular face-to-face interaction—as they do in Silicon Valley and other regions with innovation clusters—they are able to exchange ‘tacit knowledge’, a kind of knowledge that cannot be written down, recorded, or ‘codified’ (Desrochers, 2001). According to many innovation scholars, most knowledge that is relevant for the creation of new products and technologies is tacit in nature (Senker, 1993; Maskell & Malmberg, 1999).

Since innovation clusters first drew scholarly attention in the early 1990s, many economists and economic geographers have tried to understand how clusters form, function, and evolve. Some have argued that clusters revolve around certain key organizations, most notably universities and technical colleges. In their article titled *Universities and Regional Economic Development* (2008), Allison Bramwell and David Wolfe explained how universities play a very important role in most innovation clusters, as they not only generate new knowledge and skilled workers, but also provide a ‘meeting ground’ where local and regional entrepreneurs and researchers can interact. Depending on their size and level of prestige, universities can attract talented people from around the world to their locations, thus stimulating the growth of their local and regional clusters (Bramwell & Wolfe, 2008, p1178). Other organizations also play a pivotal role, including chambers of commerce, technology transfer centres, and producers’ associations. These organizations disseminate information among local and regional actors, host community-building events, and foster “a common culture of innovation” (Wolfe & Gertler, 2001, p158). In a sense, they provide the connective tissue that holds clusters together. According to Holger Graf (2011), an economic geographer at the University of Jena, some organizations are

embedded in innovation clusters while being part of national and international scientific and business communities. By using their national and international connections, these organizations can bring outside knowledge and information into clusters. Graf referred to such organizations as 'gatekeeper organizations'.

Most innovation clusters throughout world contain business incubators and technology incubators, facilities that house innovative firms in their early stages of development. Equipped with communal offices, laboratories, auditoriums, and event rooms, incubators provide young firms with the space, technical support, and other resources needed to successfully develop and launch new products. When a firm becomes a tenant in an incubator, it receives access to work space, advanced equipment, legal and financial services, and mentorship from experienced entrepreneurs and business managers. It also receives opportunities to collaborate with other firms inside the incubator (and even outside the incubator), thereby becoming part of an innovation network. Incubators have been studied by many innovation scholars over the years. Rudy Aernoudt, a Belgian economist and senior civil servant, discussed the history and evolution of incubators in his article titled *Incubators: Tools for Entrepreneurship* (2004). He explained how the first incubators were created in Europe and North America in the 1970s and 1980s as a means of revitalizing the economies of regions and cities suffering from de-industrialization. Early incubators provided services to firms of all types, while later incubators specifically targeted firms in high-tech industries, such as biotechnology, information technology, and environmental technology (Aernoudt, 2004, p128-129). A number of economists and economic geographers have tried to evaluate the performance of incubators based on their ability to nurture and support young firms. Using both qualitative and quantitative research methods, these scholars have tried to determine the degree to which incubators help young firms carry out

innovations, network with other organizations, and advance through the different stages of business development (Colombo & Delmastro, 2002; Tamasy, 2007, p465; Sa & Lee, 2012; Minguilio, Tijssen & Thelwall, 2015; Sedita et al., 2018). They also explored whether incubators generate employment and new business creation in certain regions. Some of these scholars have found that incubators accelerate firm growth, spur innovation, and drive regional economic development. Others, however, have found that incubators have a negligible effect on both individual firms and regional economies.

Innovation Network Policy Literature (Global)

All of the scholars discussed in the previous section added depth and complexity to our understanding of innovation by showing how the innovative process is collaborative and communal. These scholars shifted the focus of innovation studies away from individual entrepreneurs, firms, and laboratories, and towards innovation networks and clusters (Freeman, 1987; Lundvall, 1988; Nelson, 1990; Porter, 1990). Some of them recognized that governments can create, support, and expand networks and clusters through a variety of public programs and policy interventions. Bengt-Åke Lundvall, for example, noted that governments can create links between producer firms and user firms, and also strengthen and restructure existing producer-user relationships:

“Government may intervene, directly or indirectly, in relation to the establishment and restructuring of patterns of user-producer relationships. In a period characterized by gradual technical change and incremental innovations, a national government might sustain national and international user-producer linkages which already exist. It might also support the establishment of specific organizations, intermediating between groups of users and groups of producers, pooling information, and thereby stimulating the production and diffusion of innovations. In a period characterized by radical innovations and a shift in technological paradigm, the task of government becomes vastly more complex and important. In such a period, there is a need for a transformation of the existing network of user-producer relationships” (Lundvall, 1988, p358).

Michael Porter showed how governments have different means of facilitating collaboration between firms, universities, and public research institutions. For example, governments can encourage firms to carry out joint research projects with universities by providing subsidies or grants for such projects (Porter, 1990, p633). They can also help universities and public research institutions share their scientific and technological discoveries with firms by funding science-industry workshops, conferences, and forums. Porter pointed out that, in Denmark, the national government hired special agents to transmit information from public agricultural laboratories to private agricultural firms, and to assist these firms with the adoption of new agricultural technologies (Porter, 1990, p634). All of these measures allow firms and public research bodies to overcome their cultural and institutional differences, and work together as collaborative partners.

As we saw in the previous section, Porter is best known for his thoughts and writings on innovation clusters. Throughout his long and storied career as an academic and business consultant, Porter developed a highly influential theory of cluster formation, and raised awareness of clusters among economists, business leaders, politicians, and civil servants. He also advised governments on how they can support the growth and development of clusters. In his article titled *Location, Competition, and Economic Development* (2000), Porter recommended that governments attract foreign investment to regions where clusters exist, and invest in key organizations and infrastructure within these regions. Moreover, he suggested that governments “sponsor forums to bring together cluster participants, mount cluster-specific efforts to attract suppliers and service providers from other locations, [and] establish cluster-oriented free trade zones, industrial parks, or supplier parks” (Porter, 2000, p28). It is very important that governments try to support and reinforce existing clusters, Porter argued, instead of trying to

create entirely new clusters (Porter, 2000, p28). Inspired by the ideas of Porter, governments in Europe, North America, and Asia began carrying out large-scale innovation cluster initiatives in the 1990s and 2000s. As these initiatives proliferated around the world, some innovation scholars sought to understand how they are designed, planned, and implemented (Lee, 2001; Ache, 2002, p76-86; Rooney, 2002, p59-68). One of these scholars, Phillip Raines, discovered that most cluster initiatives proceed through four different stages (Raines, 2002a, p163-172). During the first stage, governments examine the various clusters that exist within their jurisdictions, taking note of their structures, industrial focuses, and sources of competitive advantage. After conducting these ‘cluster analyses’, governments identify those clusters that have the greatest potential to become internationally-competitive. During the second stage, governments carry out consultations with individuals and organizations within the chosen clusters, allowing them to determine what additional resources the clusters need to develop and expand. They also select policy tools that can support cluster growth and expansion. Most relevant policy tools seek to promote collaboration between cluster agents/participants:

“Clusters are defined by the interactions amongst their main agents, frequently inter-sectoral and involving both businesses and research providers such as universities. To develop networking among potential cluster participants, policy must create the conditions for cooperation as well as increase—or at least highlight—the incentives to take part. Various policy measures support this activity, including: measures to increase the incentives for cooperation on RTD and technology transfer; targeted inward investment to attract new agents into the cluster; the provision of publicly-funded infrastructure such as science parks to encourage interactive agglomerations; and the public sector acting as brokers for cluster agents interested in finding partners. All of these have been recurring tools of intervention in cluster policies” (Raines, 2002b, p28).

Once governments select the appropriate policy tools, they put these tools into practice. During the final stage, governments assess the outcomes of their initiatives. They try to determine whether the policy tools used were effective in growing and strengthening the clusters, and in enhancing the innovative performance of cluster agents.

As innovation cluster initiatives have been launched around the world, some scholars have raised doubts and concerns about their effectiveness. One such scholar, Matthias Kiese (2019), explains how policymakers may plan and execute cluster initiatives poorly because they lack certain competencies and resources (both financial and institutional). For example, policymakers may lack the knowledge, time, and budgetary flexibility needed to conduct extensive cluster analyses, and thus identify clusters with strong growth potential. If policymakers cannot identify promising clusters, then they may accidentally invest in hopelessly stagnant or stunted clusters, thereby wasting taxpayer money (Kiese, 2019, p1709). Even if policymakers identify the right clusters, they may choose the wrong policy tools to support them. As Kiese explains, the most impactful policy tools take years or even decades to produce results, making them undesirable to policymakers, who operate under heavy time constraints (Kiese, 2019, p1708). In his article titled *California Dreamin': The Feeble Case for Cluster Policies* (2011), Gilles Duranton argues that cluster initiatives may fail because of information asymmetries between policymakers, cluster agents (or 'producers'), and voters:

“The producers in a cluster will know more about their activity, their level of performance, and the local prospects than the authority in charge of cluster policies. In turn, the local policymakers will know much more than their voters. This double asymmetry of information can be particularly detrimental. In the worst case scenario, a group of industries can collude with their local authority and use a cluster initiative as a way to extract resources for themselves. A less extreme version suggests that producers may be able to mislead policymakers and that this can go unnoticed by the voters” (Duranton, 2011, p26).

The message of both Kiese and Duranton is very clear: instead of stimulating regional economic growth and encouraging collaborative innovation, cluster initiatives may simply squander public resources and create opportunities for corruption and rent seeking. Given the myriad risks and dangers associated with cluster initiatives, governments should allow innovation clusters to form and develop on their own.

For decades, innovation scholars have thoroughly studied and documented network/cluster initiatives in a number of European countries, including Britain (He, MacNeill & Wang, 2014), Germany (Kaiser, 2003; Falck, Heblich & Kipar, 2010; Gebhardt, 2013), Austria (Kaufmann, 2007), Italy (Caligano & Fitjar, 2017), Sweden (Lundmark & Pettersson, 2012), and Denmark (Rooney, 2002). In each of these countries, national and regional governments have brought firms, universities, and research institutions closer together by funding collaborative research projects, organizing public-private research consortia, and investing in physical innovation spaces (science parks, technology incubators, and communal research laboratories). Some of these governments have promoted networks and clusters under the direct guidance of the European Council, which views networks and clusters as central pillars of Europe's knowledge economy. Scholars have also studied network/cluster initiatives in various Asian countries. In his article titled *Japan's Industrial Policy for New Technologies* (1986), Kazutoshi Koshiro explained how the national government of Japan encouraged large electronics firms to cooperate with each other throughout the 1970s and 1980s. As these firms worked together under the watchful eye of the Japanese Ministry of International Trade and Industry (MITI), they were able to create computer technologies that rivalled those in the United States. In 2001, the Japanese national government launched the Knowledge Cluster Initiative and the Industrial Cluster Program, two large-scale innovation network programs, both of which were discussed by Masayuki Kondo (2006). Kongrae Lee (2003) examined South Korea's Regional Research Centre (RRC) program, which sponsored almost forty university-led research consortia throughout the 1990s. Yuliani Suseno and Craig Standing (2018) looked at Singapore's National Research Foundation (NRF), a public research-funding organization chaired by the prime minister. NRF's primary goal, Suseno and Standing explained, is not only to fund university

research, but also to promote university-industry collaboration across Singapore (Suseno & Standing, 2018, p288).

All of the scholars mentioned above provided rich, detailed descriptions of innovation network/cluster initiatives in Europe and Asia. None of them, however, explored the similarities and differences between initiatives at the national and regional levels. In fact, only a few scholars have ever compared national and regional network/cluster initiatives. One of these scholars, Sam Garrett-Jones (2004), examined national-level and regional-level science and technology programs in Australia. He showed how Australia's national and regional governments both promote innovation networks by providing grants to small technology firms, funding collaborative research projects, and creating physical spaces for collaborative innovation. These governments pursue very similar innovation network strategies, as they use the same policy tools to bring innovative organizations together. Garrett-Jones suggested that regional governments have a more 'grassroots' approach to creating and supporting networks, but did not elaborate on this point (Garrett-Jones, 2004, p8). The findings of this dissertation are somewhat aligned with those of Garrett-Jones.

Innovation Network Policy Literature (Canada)

Since the mid-1990s, many books and articles have been written on innovation networks in Canada and the government policies and programs that support them. One of the most well-known books on this topic is *Canada's National System of Innovation* (2001) by Jorge Niosi. This book discussed the history and evolution of Canada's 'innovation system'—that is, the set of institutions, organizations, and policies in Canada that contribute to scientific advancement and innovation. Throughout most of the twentieth century, the book explained, universities and public research laboratories in Canada did not interact or engage with private firms, but carried

out their research activities in relative isolation from the private sector (Niosi, 2001, p98). In the 1980s, however, these organizations became much more open to collaboration with firms. By the early 1990s, the majority of Canada's universities and public laboratories were actively assisting firms, either by licensing and transferring technologies to them or by partnering with them on innovative projects (Niosi, 2001, p100-115). The book offered two different explanations for this phenomenon. First, these organizations saw cooperation with private firms as an opportunity to generate revenue at a time when their budgets were being cut by federal and provincial governments. Second, these organizations were subject to new government policies and programs compelling them to interact with firms. The book did not identify these policies and programs, however, nor did it explain how they function. One of the programs that the book was likely referring to was the Networks of Centres of Excellence (NCE) program, which was introduced by the federal government in 1989. Jointly administered by the three federal granting councils, the NCE program brought firms, universities, and research institutions together across Canada to perform collaborative research and development. This program was discussed at length by Donald Fisher, Janet Atkinson-Grosjean, and Dawn House in their article titled *Changes in Academy/Industry/State Relations in Canada* (2001). Drawing from federal government documents and interviews with federal policymakers, these scholars explained how the NCE program originated and evolved over time, and how it was structured and administrated. Janet Atkinson-Grosjean wrote an entire book on the Canadian Genetic Diseases Network, an innovation network created and funded through the NCE program (Atkinson-Grosjean, 2006).

Following in the footsteps of Atkinson-Grosjean and her colleagues, many scholars have examined innovation network programs in Canada at the federal level. For example, Creso Sa and Jeffrey Litwin (2011) looked at federal programs that aim to forge stronger linkages between

universities and private firms. They focussed especially on the NCE program and other programs administered by Canada's federal granting councils (NSERC, SSHRC, and CIHR) (Sa & Litwin, 2011, p430-431). In their magisterial book *Canadian Science, Technology, and Innovation Policy* (2016), Bruce Doern, David Castle, and Peter Phillips provided a sweeping exposition of "Canada's science, technology, and innovation (STI) policy and related governance system over the past half century" (Doern, Castle & Phillips, 2016, p3). This exposition covered STI policy under five different Prime Ministers—namely, Pierre Trudeau, Brian Mulroney, Jean Chretien, Paul Martin, and Stephen Harper. During the reign of Jean Chretien, the authors explained, the federal government became highly interested in creating, sustaining, and expanding innovation networks (Doern, Castle & Phillips, 2016, p220). It established the Canadian Institutes of Health Research, Genome Canada, and the Canada Foundation for Innovation, which are all agencies that directly or indirectly support networks. One year after the publication of this book, the federal government launched the Innovation Supercluster Initiative, which created five virtual innovation networks—or 'superclusters'—across Canada. This program was discussed and critiqued by David Doloreaux and Richard Shearmur in their article titled *Moving Maritime Clusters to the Next Level* (2018). These scholars warned that the program may produce more benefits for large corporations than for small and medium-sized enterprises. They also warned that any intellectual property that is generated through the Supercluster Initiative may not stay in Canada, because many supercluster participants are multinational corporations (Doloreaux & Shearmur, 2018, p35).

As we saw in the introductory chapter, innovation networks have not only been created and supported by the federal government, but also by provincial governments. In fact, the first formal and systematic innovation network program introduced in Canada, the Ontario Centres of

Excellence (OCE) program, was carried out by the provincial government of Ontario in 1986. The OCE program sponsored seven research consortia throughout Ontario. Each consortium brought together multiple universities and private firms, and focused on fundamental research rather than applied research. In his article titled *University-Industry Interaction in the Ontario Centres of Excellence* (1996), Stephen Bell discussed the origins of the OCE program, and evaluated the program using a combination of surveys and network analysis. As part of his evaluation, he determined the frequency and quality of university-firm interactions within OCE-funded consortia. After launching the OCE program, the government of Ontario continued to promote innovation networks by establishing the Sector Partnership Fund (SPF). With a budget of \$150 million, the SPF encouraged firms in the same industry to come together to identify common challenges and discover ways to collectively address these challenges. The SPF was terminated in 1995, when Mike Harris was elected premier of Ontario. A few years later, the Harris government introduced its own innovation network programs, most notably the R&D Challenge Fund. All of these programs have been discussed by a number of scholars, including Stephen Clarkson (1999), David Wolfe and Meric Gertler (2001), Neil Bradford (2003), and Michele Mastroeni (2022). According to Wolfe and Gertler, these programs produced mixed results. On the one hand, they helped increase productivity and efficiency in certain industries, especially in manufacturing (Wolfe & Gertler, 2001, p589). On the other hand, they failed to achieve their ultimate goal, which was to transform Ontario into a ‘learning region’ —that is, a region where firms habitually engage in interactive learning with each other and with public knowledge-generating bodies. These programs “fell short of their ambitious objectives” because they could not overcome the “individualistic and anti-cooperative ethos which characterizes Ontario’s industrial culture” (Wolfe and Gertler, 2001, p590).

In the 2000s, the provincial government of Ontario sought to help private biomedical firms gain access to life sciences knowledge, and use this knowledge to develop new medical technologies and healthcare products. By supporting the commercial exploitation of life sciences knowledge, the government hoped to grow Ontario's burgeoning biomedical industry, which it believed could become internationally competitive. Stephen Thompson, a policy advisor within Ontario's Ministry of Economic Development, Trade, and Employment, wrote an article describing the government's life sciences commercialization strategy during this time (Thompson, 2014). He explained how the government brought biomedical firms into closer contact with universities and life sciences research institutions by revamping the Ontario Centres of Excellence program and introducing new vouchers for collaborative research. Most importantly, the government funded the construction of the MaRS Centre, a giant technology incubator in downtown Toronto where biomedical firms and research institutions can co-locate and share office and laboratory space. Of course, the MaRS Centre does not only house innovative organizations in the biomedical/life sciences industry. It also houses organizations engaged in finance, cybersecurity, data analytics, energy, advanced manufacturing, and other knowledge-intensive industries. Creso Sa and Hana Lee (2012), two professors at the University of Toronto, conducted a study of organizations that reside inside the MaRS Centre. Through interviews with entrepreneurs, business executives, and business managers, these scholars sought to understand how MaRS-based organizations collaborate with each other, and how the incubator enables and facilitates this collaboration. They discovered that the physical layout of the incubator allows actors from different organizations to frequently "bump into each other" and develop personal bonds (Sa & Lee, 2012, p248). Moreover, the administrators of the MaRS Centre actively promote inter-organizational collaboration by hosting networking events

(workshops, conferences) and directly linking organizations that are engaged in complementary activities (Sa & Lee, 2012, p249).

While innovation network programs in Ontario have been studied, discussed, and critiqued extensively by scholars, those in Alberta have not. The provincial government of Alberta has tried to promote innovation networks in an ad-hoc fashion since the 1970s, yet these efforts have received very little scholarly attention. Any academic analysis of Alberta's network programs has been cursory and somewhat shallow. In his article titled *Policy Transfer and Diversification in Resource Dependent Economies* (2018), Peter Howie argued that the Alberta government has been a major proponent of 'open innovation'—that is, “a technological innovation method where new technology is developed under a consortium with technical inputs from various companies and government experts” (Howie, 2018, p121). He only provided two examples of open innovation in Alberta, however, both of which revolved around oil extraction (Howie, 2018, p119). Howie did not discuss or even mention any of the innovation network programs that were launched by the Alberta government since the mid-1990s. These programs have been discussed by some scholars, but only in a desultory fashion (Garrett-Jones, 2007, p43; Sa, 2010, p349; Woiceshyn & Eriksson, 2014). Special acknowledgement should be given to Richard Hawkins, professor of communications at the University of Calgary, and Peter Josty, director of an Alberta-based technology research institution. Together, Hawkins and Josty wrote a lengthy article about provincial innovation policy (broadly conceived) in Alberta (Hawkins & Josty, 2022). In their article, these two authors discussed the creation of various provincially-funded organizations focused on science, technology, and innovation. These organizations include the Alberta Oil Sands Technology and Research Authority, the Alberta Heritage Foundation for Medical Research, Alberta iCore, and Alberta Innovates. The authors did not

explain, however, how these organizations help form innovation networks. The article by Hawkins and Josty is one of many contributions to a book on provincial innovation policy in Canada (Castle & Phillips, 2022). Each chapter in this book explores innovation policy in a particular province, but does not compare provincial-level and federal-level innovation policy.

Throughout the 1990s and 2000s, Canada's biotechnology industry experienced dramatic growth, as the number of biotechnology firms increased rapidly. Jorge Niosi and Tomas Bas (2004) attributed this growth (at least partially) to federal and provincial programs that helped biotechnology firms access investment capital, scientific knowledge, and other resources. They identified a number of programs, such as the federal government's NCE program and the Ontario government's Biotechnology Commercialization Centre Fund, that integrated small biotechnology firms into innovation networks. At no point, however, did these scholars compare federal-level and provincial-level network programs for biotechnology. Like Niosi and Bas, Merli Tamtik (2017) examined innovation programs at both the federal and provincial levels. She argued that Canada's federal and provincial governments carry out innovation programs without communicating or consulting with each other, and without engaging in any kind of inter-governmental planning or coordination. As a result, innovative actors and organizations in Canada are confronted with an array of programs that lack coherence and consistency, and sometimes conflict with each other. This situation hurts Canada's overall innovative performance:

“Despite significant monetary allocations, recent policy reports have referred to a continuous innovation under-performance in Canada, linking it to a lack of policy coordination between the federal and provincial governments. Universities and the private sector need to navigate this disintegrated governmental policy and program landscape, aligning their research agendas accordingly. Diffused policy development over several Ministerial departments and programs in the federal-provincial governments has resulted in mixed signals to knowledge producers, affecting overall knowledge mobilization in Canada” (Tamtik, 2017, p417).

Tamtik's critique of innovation policymaking in Canada applied to all areas of innovation policy, including innovation network policy. She did not explicitly address any innovation network programs or initiatives, however, either at the federal or provincial levels.

One Canadian scholar who deserves special attention is Charles Conteh, a political scientist specializing in comparative public policy and multi-level governance. In his book *Policy Governance in Multi-Level Systems* (2013), Conteh discussed the evolution of regional economic development policy in Canada from 1960 to 2010. He explained how, in the 1990s, the focus of regional development policy shifted away from building basic industrial infrastructure and supporting individual enterprises, and towards promoting innovation clusters or 'networked regional economies'. During this period, the federal government's regional development agencies launched various programs to help poor or economically less developed regions develop their capacities for knowledge production, inter-organizational learning, and collaborative innovation. According to Conteh, the regional development agencies often designed and implemented these programs in close cooperation with provincial governments. At the same time, many provincial governments carried out their own innovation cluster programs independently from the federal government. For example, the government of Manitoba sponsored conferences where local entrepreneurs and researchers could meet each other and exchange technical knowledge (Conteh, 2013, p114). Conteh's analysis focused mostly on the political processes and governance frameworks that shaped regional development programs, including innovation cluster programs. It focussed very little on the actual structures and characteristics of these programs. It is somewhat difficult, therefore, to discern the similarities and differences between federal and provincial programs based on Conteh's work.

Many of the Canadian scholars discussed above were deeply familiar with Bengt-Åke Lundvall, Richard Nelson, Michael Porter, and other pioneers of innovation network/cluster theory. In their books and articles, they made countless references to these venerated theorists, often crediting them for laying important conceptual foundations (Niosi, 2000, p5; Doern, Castle & Philips, 2016, p22). They also shared many of their core assumptions—namely, that innovation is a collaborative process, and that governments (both national and regional) must try to foster inter-organizational collaboration through a variety of means. Some of them argued that Canada’s federal and provincial governments are directly influenced by these theorists, basing their innovation network programs on their ideas. For example, Stephen Clarkson (1999) and David Wolfe and Meric Gertler (2001) suggested that the provincial government of Ontario closely followed Michael Porter’s blueprint for innovation cluster formation throughout the 1990s. Janet Atkinson-Grosjean pointed out that, during the era of Jean Chretien, the federal government sought to create a ‘national system of innovation’, a concept that was drawn entirely from the writings of Richard Nelson and Christopher Freeman (Atkinson-Grosjean, 2001, p307). Canadian politicians and civil servants fully adopted the language and framework put forward by world-renowned innovation network theorists.

Innovation Policy Literature

All innovation network policies aim to create connections between public and private innovative organizations, thereby facilitating the exchange of knowledge, the sharing of technology, and the planning and execution of joint R&D projects. By supporting inter-organizational dialogue, cooperation, and learning, these policies help accelerate the pace of innovation. It is important to recognize, however, that governments have other means of promoting and stimulating innovation. For example, they can lower taxes on highly-innovative

firms, introduce worker retraining programs, increase funding for basic scientific research, and eliminate certain business regulations. In a recently published article, Dosi et al. (2023) distinguished between two different types of innovation policies: ‘direct’ policies and ‘indirect’ policies. Direct policies seek to develop and advance specific products and technologies, especially those that are unproven, path-breaking, and high-risk. Alternatively, they seek to channel public and private resources into particular industries or areas of technology, such as biotechnology and genomics. This is done by funding applied R&D projects and research facilities, organizing research consortia and conferences, and coordinating public-private partnerships and knowledge mobilization schemes. Clearly, innovation network policies can be classified as *direct* innovation policies since they bring public and private organizations together to conduct joint R&D projects, many of which revolve around path-breaking products and technologies. In contrast, indirect policies seek to increase the overall level of innovation in the economy by fixing ‘market failures’ and by improving the macroeconomic environment in which all innovative actors operate. Indirect policies can be described as *laissez-faire* and ‘market-friendly’, because they allow the private sector to make all executive decisions about R&D and innovation (including the setting of research agendas, the selection of new technological paths, and the organization of research projects).

Most mainstream or orthodox economists believe that markets, rather than governments, should drive the innovative process. In their view, only private companies, private investors, and consumers should decide what new products and technologies are worthy of investment and development; governments are incapable of making such judgements (Nooteboom & Stam, 2008). Given their faith in markets, these economists support *indirect* innovation policies that give free rein to the private sector. Specifically, they support the reduction of taxes on corporate

profits, personal incomes, and capital gains (Slivinski & Singleton, 1999). By allowing individuals and companies to keep more of their earnings, tax cuts lead to increased spending on R&D and increased investment in new business ventures. These economists also support the provision of tax credits for R&D; essentially, these tax credits allow companies to pay lower taxes if they invest in new products and processes or generate new technical knowledge (Moretti, 2014). Many orthodox economists advocate for the reduction (and even total elimination) of business regulations, such as labour laws, health and safety laws, and environmental laws. They argue that business regulations stifle and impede innovation by discouraging entrepreneurship, punishing dynamic companies, and slowing the pace of technological change (The Economist, 2013; Crews, 2018; Aghion, Bergeaud & Reenen, 2023). Many believe that the more time and energy companies must spend on regulatory compliance, the less time and energy they have for R&D and innovation (Coffey et al., 2016).

Unlike orthodox economists, heterodox economists support *direct* innovation policies that shape and influence the direction of innovation from above. One of the most notable heterodox economists is Mariana Mazzucato, the founder of the Institute for Innovation and Public Purpose at University College London. In her provocative and polarizing book *The Entrepreneurial State* (2013), Mazzucato argued that, in order to spur innovation, governments cannot simply cut taxes, provide tax credits to innovative companies, and remove cumbersome regulations. Rather, they must identify new technologies that have strong commercial potential, and then directly fund the testing, prototyping, demonstration, and commercialization of these technologies. Governments must play a much more ‘hands-on’ and ‘active’ role in the innovative process, therefore, than orthodox economists believe. According to Mazzucato, many governments in the western world have directly contributed to technological innovation in the

past. In fact, most of the defining technologies of the modern age—for example, the microprocessor, personal computer, monoclonal antibody, hard drive, Internet, and global positioning system—were products of large-scale R&D projects directly funded by governments. It should be noted that Mazzucato has received criticism from orthodox economists on both empirical and theoretical grounds (Mingardi, 2015; Audretsch & Fielder, 2023).

Orthodox economists in Canada, like those in other countries, vigorously support tax cuts for entrepreneurs, investors, and established companies (Clemens, Lammam & Veldhuis, 2017). One of the most vocal advocates for tax cuts in Canada is Steven Globerman, a senior fellow at the Fraser Institute, Canada’s preeminent economic think tank. In his article titled *Taxes, Innovation, and Productivity Growth* (2023), Globerman fulminated against Canada’s high corporate and personal income tax rates, which he blamed for the country’s relatively poor innovation performance. He suggested that Canadian tech companies, entrepreneurs, and skilled workers are relocating to other countries—especially to the United States—in order to avoid paying high taxes. This loss of knowledge and talent is making Canada less innovative, productive, and competitive:

“Canada has had an undistinguished record of innovation performance compared to other advanced economies. Its relatively poor performance in innovation is consistent with its uncompetitive tax environment. The Tax Foundation identifies Canada as having relatively uncompetitive corporate and personal income tax environments compared to other wealthy countries that rank higher in innovation performance. Of particular concern is the decline in Canada’s tax competitiveness ranking relative to that of the US in recent years. Given the substantial cross-border migration of highly educated individuals between Canada and the US, as well as the large amount of cross-border corporate investment, a less attractive tax environment in Canada relative to the US is a significant potential handicap to increased innovation in Canada” (Globerman, 2023, p1).

In another article, Globerman argued that the Canadian federal government can spur innovation not only by cutting tax rates, but also by exposing Canadian companies to greater foreign

competition (Globerman & Emes, 2019). This can be done by lifting restrictions on foreign direct investment, foreign ownership, and immigration (especially immigration of skilled engineers, scientists, and businesspeople). Other orthodox economists have recommended changes to Canada's public research-funding apparatus (Howitt, 2013), R&D tax credit system (Asselin, 2022), and trade and intellectual property regimes (Schwanen, 2017). All of these proposed changes seek to create an institutional environment that is conducive to market-driven innovation.

Some Canadian economists are skeptical of indirect or market-based innovation policies, such as tax cuts, R&D tax credits, deregulation, the expansion of free trade, and the removal of barriers to foreign direct investment. One such economist, Jim Stanford (2011a), pointed out that these policies have been implemented in Canada since the Mulroney era. They have utterly failed, however, to boost innovation and industrial productivity; in fact, Canada's productivity levels have *declined* relative to other industrialized countries over the past thirty years. Despite their apparent failures, these policies continue to be heavily endorsed by most mainstream economists in Canada:

“When it comes to Canada's lousy record in productivity and innovation, the standard prescription of economists is both clear and predictable. They believe that unregulated markets are the best way to allocate resources and determine the composition of output. Therefore, to improve efficiency and innovation, simply improve markets: (1) eliminate distorting taxes; (2) eliminate regulations; (3) sign more free trade agreements; (4) cut red tape. That will unleash the full potential of the private sector to innovate and optimize, and Canada will become a northern tiger. Canadian economic and social policy has been generally following this advice for a quarter-century. Taxes are lower, globalization is embraced, labour markets are unforgiving, business is freer (and more profitable) than at any time in our history. Ironically, however, the more vigorously we pursue the holy grail of self-adjusting markets, the worse our productivity and innovation has been. Over the last decade, Canada ranked 30th out of the 34 countries in the Organization for Economic Cooperation and Development in annual labour productivity growth. Relative to our neighbour and biggest trading partner, our record has been even worse. Since 1984 (when the Macdonald Commission recommended comprehensive free trade with the U.S., precisely to boost our productivity to their

levels), Canada's business sector has faded from 90% of U.S. productivity levels, to 70%. The promise of free trade, tax cuts, and deregulation to spur productivity (and deliver trickle-down benefits to the rest of us) has been utterly broken" (Stanford, 2011a, p1).

In order to become more innovative and productive, Stanford argued, Canada must discard all of the ineffective innovation policies favoured by mainstream, orthodox economists. It must then adopt a series of aggressive and *direct* innovation policies that can develop specific industries and technologies, create new markets, and guide the innovative process in a positive direction. Stanford's policy recommendations are very similar to those of Mazzucato (2013), the heterodox economist discussed previously. Like Mazzucato, Stanford believes that governments must become *active agents* of innovation by leading, not just facilitating, the creation of new products/technologies.

Stanford (2011a; 2011b) claims that, since the mid-1980s, Canada's federal and provincial governments have fully embraced a neoliberal economic philosophy, according to which free, unfettered markets drive innovation and productivity growth. Having completely accepted this 'free-market doctrine', these governments have refused to carry out any direct innovation policies, because such policies would interfere with natural market processes and dynamics. Instead, they have opted to cut taxes, provide R&D tax credits, and eliminate regulations and trade barriers—in other words, they have relied exclusively on *indirect* innovation policies. This claim is not supported by the historical record, however; in fact, it reflects a very narrow, biased, and tendentious reading of Canadian political and economic history. In reality, Canada's federal and provincial governments have sought to promote innovation through a combination of direct and indirect innovation policies. While these governments have indeed cut taxes, regulations, and trade barriers, they have also created and funded countless innovation networks—both virtual and anchored—across Canada. Many of

these networks have developed specific products and technologies, such as microchips (Government of Canada, 1989, p12), medical technologies (Ontario Centres of Excellence, 2004, p5-6), weather-resistant crops (Genome Prairie, 2005, p9), autonomous vehicles (Ontario Centres of Excellence, 2020), and ocean technologies (Canada's Ocean Supercluster, 2021). In addition, Canadian governments have provided direct loans to innovative companies in advanced technology sectors. For example, the Business Development Bank of Canada (a federal crown corporation) has created special investment funds for biotechnology companies, medical technology companies, and green energy companies (Niosi & Bas, 2004, p237; Business Development Bank of Canada, 2023).

In his book *Asleep at the Switch* (2014), Bruce Smardon provided a comprehensive review of federal innovation policies from 1960 to 2000. This review covered both direct innovation policies—like the Networks of Centres of Excellence (NCE) program—and indirect innovation policies—like the Scientific Research and Experimental Development (SR&ED) tax credit. Using statistical data, Smardon showed that these policies have been largely unsuccessful, as they have failed to improve Canada's innovative performance (as measured by the number of patents filed and the level of business investment in R&D). The reason why federal innovation policies have failed, according to Smardon, is because they have not addressed a major structural weakness in the Canadian economy, namely that large Canadian corporations lack the capacity for radical innovation. Unlike corporations in the United States, Europe, and Japan, Canadian corporations are unable (or perhaps unwilling) to conceive of, plan, and carry out ambitious innovative projects. This is because these corporations, many of which are subsidiaries of American corporations, have grown accustomed to borrowing productive technologies and copying product designs from the United States. Instead of conducting their own R&D, these

corporations have simply exploited the results of American R&D, allowing them to generate massive profits without taking any risks. Smardon argued that, as long as Canada continues to follow in the technological footsteps of the United States, it will never become a truly innovative nation. From this perspective, any federal innovation policies that do not address Canada's 'technological dependence' on the United States are futile. Of course, any policies that attempt to technologically de-link Canada from the United States would violate international trade agreements. It should be noted that Smardon's argument echoes previous work by Canadian political economists, such as Kari Levitt (2002 [1970]) and Mel Watkins (1993). These political economists warned, many years ago, that Canada's excessive reliance on American knowledge, technology, and capital would greatly limit its innovative potential.

Conclusion

Innovation has always been a topic of interest among economic thinkers. Some of the earliest thinkers of the modern era, such as Adam Smith and Karl Marx, recognized that continual technological change and advancement is a primary feature of capitalism. Joseph Schumpeter was the first thinker, however, to develop a theory of capitalism in which innovation is the central animating force. In Schumpeter's conceptual framework, innovation is carried out by special individuals (entrepreneurs) who are endowed with great intelligence, courage, and willpower (Schumpeter, 1983 [1934]). These individuals are assumed to create new products and technologies in isolation—that is, without any help from other actors in society. This individualistic view of the innovative process was challenged in the 1980s and 1990s by a number of critical economists and economic geographers. These critical scholars argued that innovation is a collaborative process involving a multitude of organizations, including private firms, universities, public research institutions, and training centres. They discovered that

innovation networks—not solitary firms and entrepreneurs—are the primary drivers of innovation. They also discovered that governments play a key role in the creation and expansion of these networks.

This chapter sought to review the academic literature on innovation networks from the 1980s to the present. It first discussed the works of Christopher Freeman (1987), Bengt-Ake Lundvall (1988), and Richard Nelson (1990), three scholars who spearheaded the study of innovation networks. These foundational works explained how, with the emergence of high-tech industries such as communication technology and advanced manufacturing, firms, universities, and other innovative organizations began regularly interacting with each other and sharing scientific and technical knowledge. These works also described the means through which inter-organizational knowledge exchange occurs. The chapter then discussed the works of Michael Porter (1990), AnnaLee Saxenian (1996), and other scholars who emphasized the local/regional dimension of innovation networks. Following this, the chapter looked at scholars who studied innovation network programs, both from a theoretical and empirical perspective (Lee, 2001; Raines, 2002; Kondo, 2006; Duranton, 2011; Kiese, 2019). These scholars explained how network programs are planned, designed, and implemented by governments, and how these programs impact firms, industries, and national/regional economies. The fourth section of the chapter looked at scholarly writings on network programs in Canada. Some of these writings focused on programs at the federal level (Fisher, Atkinson-Grosjean & House, 2001; Sa & Litwin, 2011; Doern, Castle & Phillips, 2016; Doloreaux & Shearmur, 2018), while others focused on programs at the provincial level (Bell, 1996; Wolfe & Gertler, 2001; Bradford, 2003; Thompson, 2014; Howie, 2018). The final section explored the broad discourse around innovation policy, which extends far beyond innovation network programs. This section

highlighted an important debate between orthodox economists, who advocate for *indirect* innovation policies, and heterodox economists, who advocate for *direct* innovation policies (Dosi et al., 2023). It was argued that innovation network programs can be classified as direct innovation policies.

Having extensively reviewed the literature on innovation network programs in Canada, three interesting observations can be made. First, this literature mostly covers programs that were launched between 1985 and 2005; very few scholarly works address network programs launched after this period. Second, the literature does not compare federal-level and provincial-level network programs; it is unclear, based on existing works, whether Canada's federal and provincial governments have similar or different approaches to promoting innovation networks. Third, the literature hardly considers how federalism, urbanization, and changing inter-governmental relations shape and influence network programs. Despite its many limitations, the literature contains many useful insights into the design and execution of specific programs, both at the federal and provincial levels. It also situates these programs within their historical context, describing the economic, political, and ideological conditions in which they emerged (Clarkson, 1999; Bradford, 2003). One work that deserves special attention is the article by Donald Fisher, Janet Atkinson-Grosjean, and Dawn House on the Networks of Centres of Excellence (NCE) program (Fisher, Atkinson-Grosjean & House, 2001). As we saw previously, this article explores the history, mission, and operation of the NCE program, drawing upon both government documents and interviews with federal policymakers. The authors emphasize that the program creates *virtual* innovation networks by linking researchers and industrial actors through electronic channels. They suggest that the architects of the program chose to create virtual networks, instead of 'fixed' or 'anchored' networks, because the federal government does not

have enough money and resources to build physical innovation spaces across Canada (Fisher, Atkinson-Grosjean & House, p310). This claim directly inspired the initial working hypothesis of this dissertation.

Chapter 4: History, Geopolitics, and Innovation Network Policy

Ever since Canada's federal and provincial governments started launching innovation network programs in the 1980s and 1990s, Canadian scholars have taken a keen interest in these programs. As Chapter 3 shows, many academic books and articles have been written about government-sponsored research consortia, learning systems, and technology incubators across Canada. Some of these scholarly works are narrow in scope, examining just one network program (Bell, 1996; Fisher, Atkinson-Grosjean & House, 2001; Doloreux & Shearmur, 2018), while others are much broader in scope, surveying and analyzing several network programs (Bradford, 2003; Sa & Litwin, 2011; Doern, Castle & Phillips, 2016). While providing rich insights into program design, implementation, and outcomes, this body of academic literature has a major lacuna: it does not consider the similarities and differences between network programs at the federal and provincial levels. The purpose of this dissertation, as stated in Chapter 1, is to determine whether federal and provincial governments have different approaches to promoting innovation networks. An early working hypothesis, it will be recalled, was that federal and provincial governments seek to create different types of network: the federal government seeks to create *virtual* networks, while provincial governments seek to create *anchored* networks. This chapter explores some of the reasons as to why federal and provincial governments may have these different preferences.

In order to understand why federal and provincial governments in Canada may pursue different innovation network policies, one must consider the different geopolitical and geoeconomic forces bearing on these governments. As the highest order of government in the country, the federal government serves as a guarantor of national unity. One of its primary goals

is to ensure that Canada's thirteen provinces and territories remain socially, culturally, and economically bound to each other, constituting a coherent national community. Historically, one of the main threats to national unity in Canada has been regional economic inequality. Since the country's founding in 1867, some provinces have possessed greater wealth and higher average incomes than others, giving rise to bitter inter-provincial and inter-regional conflicts (Brady, 1960; Forbes, 1979; Loleen & Gibbins, 2014). Fearing that these conflicts could lead to national disintegration, the federal government has tried to reduce the economic disparities between provinces and regions through a series of interventionist economic policies (Aucoin & Bakvis, 1984; Savoie, 2006; Bryden, 2007a). Many of these policies have aimed to stimulate economic activity in lagging provinces and regions by funding vital economic infrastructure and providing direct grants to businesses. In the late 1980s, the federal government discovered a new tool with which to promote provincial/regional economic equality: innovation network policy. By linking universities, research institutions, and firms across the country, innovation network policy promised not only to accelerate economic growth in Canada's fastest-growing provinces (Ontario, Quebec, Alberta, and British Columbia), but also to integrate Canada's lagging provinces into the knowledge-based and high-tech economy. It was important to federal policymakers that innovation networks be created in every province, not just in those with large concentrations of human capital and high-tech firms (Fisher, Atkinson-Grosjean & House, 2001). To ensure that networks are widely distributed among the provinces, it is argued here, the federal government had to create *virtual* innovation networks that link innovative actors through electronic channels. Virtual networks were chosen over anchored networks because the federal government simply could not afford to build science parks and technology incubators in the major cities of every province.

For the moment, we will assume that the federal government has a preference for virtual innovation networks—an assumption which, of course, will be shown to be inaccurate. Nevertheless, it is important to explore this argument so as to understand how the research presented in this dissertation iteratively evolved as the empirical evidence was engaged. This preference for virtual networks may be explained by the federal government’s commitment to regional economic balance, as was suggested above. Conversely, we will assume that provincial governments have a preference for anchored innovation networks. Once again, although this argument is ultimately revised it is important to understand it, so as to appreciate how the inductive research moved forward. This preference for anchored networks may also be explained by geopolitical factors—specifically, by the strong political influence of cities and municipal governments with provincial policymakers. Since the 1980s, political and economic elites in Canadian cities have pressured provincial governments to fund science parks, technology incubators, and other physical ‘innovation centres’ in their local jurisdictions. Following a doctrine of ‘entrepreneurial urban governance’ (Harvey, 1989), these elites hope that the presence of innovation centres (or ‘technopoles’) will make their cities more visible and competitive in the global economy. With their futuristic-looking office and laboratory spaces, innovation centres supposedly function as magnets, attracting investment, skilled workers, and media attention from around the world. Under intense pressure to create and support innovation centres that will impress global observers, provincial governments have invested hundreds of millions of dollars in the construction and expansion of these facilities. The remainder of this chapter will further explore how geopolitical and geoeconomic forces shape innovation network policy in Canada, drawing upon scholarly writings on federalism, multilevel governance, and international political economy.

Before proceeding, it is important to clearly define the term ‘geopolitics’. Typically, this term refers to the interactions and power relations among countries in an ever-changing world order (Short, 2021). In the context of this dissertation, however, it has a different and more general meaning, referring to the political dynamics and social/power relations among state and non-state actors operating at different geographical scales (local, regional, national, and international). It is a very broad concept encompassing a wide array of multi-scalar political phenomena, including federal-provincial cooperation and rivalry, civil society mobilization, interest group lobbying, and inter-regional conflict. It is much broader than ‘federalism’, which only captures the relations between central governments and provincial/regional governments, largely excluding non-state actors (Broadway, 2012). It is also broader than ‘regionalism’, which only captures political processes at the regional or subnational level. It is a useful term because it encapsulates both intergovernmental relations (federal-provincial relations, local-provincial relations) and broad social forces (social movements, shifts in political culture and climate, shifts in population). It should be noted that geopolitics, as defined here, bears some similarities to ‘multilevel governance’ (Young, 2012, Conteh, 2021).

Regional Development Policy and Virtual Networks

Between the years 1930 and 1970, countries in western Europe and North America faced a major problem of regional economic inequality. Within each country, some regions experienced rapid industrialization and employment growth, while others languished in a state of economic backwardness (Crum, 1936, p221; Williamson, 1965; Green, 1969, p572; Hansen, 2001, p1). National governments feared that these inter-regional economic disparities would not only harm national economic performance, but also undermine national political unity and solidarity. If regional inequality is allowed to persist, these governments believed, then inter-regional relations

may become hostile, and citizens residing in poor regions may feel alienated from the national political community. In an attempt to “equalize living standards and employment opportunities between regions” (Breathnach, 2010, p1182), national governments introduced a number of regional development policies, all of which were designed to enhance the economic capacity of poor or underdeveloped regions. According to Gavin McCrone, a prominent British economist in the 1960s and 1970s, regional development policies were partly motivated by social and political considerations, rather than purely economic considerations:

“In most countries regional development policies have come about in response to a mixture of political, social, and economic pressures, and it is not always possible to say which has played the dominant role. The existence of regional unemployment on a serious scale seems to be the factor which exerts the greatest influence in inducing governments to take action. But this action is probably prompted as much by the political consequences of unemployment and the social need to give everyone an opportunity for work as by considerations of making the best use of the nation’s economic resources” (McCrone, 1969, p25).

Regional development policies sought to address the problem of regional underdevelopment in different ways. Some provided grants and subsidies to private businesses operating in poor regions, while others funded the construction of major transportation and communication infrastructure. Perhaps the most well-known regional development policies in the post-war era were carried out by the US federal government; between 1930 and 1960, the federal government funded the construction of highways, bridges, dams, irrigation systems, and airports in America’s most economically depressed regions (Petach, 2021).

In Canada, the federal government first became concerned with the issue of regional economic inequality in 1926, when it received a report from a royal commission on the economic state of the Maritime provinces. According to the report, the Maritime provinces were not as economically robust as other provinces, and constituted an underdeveloped region in Canada:

“The outstanding fact, it seems to us, is that the Maritime provinces have not prospered and

developed, either in population, or in commercial, industrial and rural enterprise, as fully as other portions of Canada” (Duncan, Wallace & Macmillan, 1926, p9). This report did not discuss the structural causes of poverty and economic stagnation in the Maritime provinces, as this would have required an analysis of uneven economic development and core-periphery relations. Instead, it simply recognized that the Maritime provinces were suffering economically, and proposed a number of policies that might alleviate this suffering. The authors of the report, who possessed a mix of legal, academic, and industrial expertise, sought to help the Maritime provinces advance economically, bringing them “into line with the prospects of other parts of Canada and prospects of the Dominion as a whole” (Duncan, Wallace & Macmillan, 1926, p10). The policies proposed by the report included the provision of special subsidies, the adjustment of tariffs, the expansion and improvement of Maritime ports, and the lowering of freight rates. Unfortunately, the federal government was not able to implement these policies because federal cabinet members could not agree on the costs involved (Forbes, 1979, p173). It is worth noting that the royal commission report identified regional economic balance as one of the original ‘hopes’ of Confederation. Although regional balance cannot be fully achieved, the report argued, it is a goal that Canada must always aspire to:

“It is not possible in such an undertaking as the making of Canada, with its geographical and physical conditions, and its variety of settlement and development, to maintain always an accurate balance, apportioning to every section of this extensive country the exact quality of benefit and quantity of advantage which would be theoretically and justly desirable. But reasonable balance is within accomplishment if there be periodic stocktaking...[This report] should now be reviewed with sympathetic consideration and understanding, so that in approaching the future a better balance of territorial prosperity can be assured, and the original hope of Confederation—unity, prosperity, and contentment, for all the provinces, as well as for the whole of Canada—can be made capable of realization” (Duncan, Wallace & Macmillan, 1926, p9).

After the second world war, the federal government discovered a fiscal imbalance between Canada's provinces. Some provinces were able to provide their residents with high-quality public services (like education and welfare), while others were not due to a lack of sufficient tax revenue. In response, the federal government introduced a system of 'fiscal equalization', which provided grants to less-wealthy provinces, allowing them to afford public services that meet the 'national standard' (Lecours & Beland, 2010, p571). Soon after implementing equalization, the federal government received another report from a royal commission, this one authored by Walter Gordon, a fierce economic nationalist and future Liberal finance minister. The Gordon Report, as it was called, noted that Canada's provinces differed greatly in their levels of economic growth; Ontario and Quebec were growing quickly, the report stated, while Saskatchewan, Manitoba, and the Atlantic provinces were lagging far behind. Moreover, Canada's slow-growing provinces had much higher levels of poverty and unemployment than the country's fast-growing provinces. To remedy this situation, the Gordon Report called for "an ambitious regional economic development policy to complement the equalization framework, tackling income and employment disparities through strategies of industrial modernization, business attraction, rural revitalization, and labour mobility" (Bradford & Wolfe, 2013, p335). The federal government heeded the advice of the Gordon Report, introducing its first regional development policy in 1961: the Agricultural Rehabilitation and Development Act (Aucoin & Bakvis, 1984). This policy sought to improve economic conditions in the Prairie and Atlantic provinces by "providing assistance for alternative use of marginal land, creating work opportunities in rural areas, developing water and soil resources, and setting up projects designed to benefit people engaged in natural resource industries other than agriculture, such as fisheries" (Savoie, 2006, p83).

With the election of Pierre Trudeau as Prime Minister in 1968, regional economic balance became a primary goal of the federal government. In his early speeches as Prime Minister, Trudeau argued that regional economic disparities posed an existential threat to Canada—in fact, he suggested that these disparities were as harmful to Canadian national unity as the Quebec separatist movement (Bryden, 2007a, p481). Just one year after coming to power, Trudeau oversaw the creation of a new federal department dedicated to regional economic development: the Department of Regional Economic Expansion (DREE). Over the next decade, DREE carried out economic development projects in every province, with a particular focus on the Atlantic provinces (Savoie, 2006, p89). These development projects mostly involved the creation of highways, water and sewage systems, industrial parks, and other infrastructure conducive to economic growth. DREE also incentivized Canadian businesses to build manufacturing plants, warehouses, and other facilities in cities that were economically stagnant, such as Halifax, St. John's, Moncton, and Trois-Rivières. Although DREE's focus was meant to be the economic lagging areas of Eastern Quebec and the Atlantic provinces, after the October Crisis in 1970, it was ordered to include the Montreal area in its activities as the Trudeau government looked for ways to mollify anti-federalist opinion in Quebec (Bryden, 2007a, p482). The federal government's approach to regional economic development changed in the mid-1980s with the rise of Brian Mulroney to power. Mulroney and his Progressive Conservative Party noticed that, as the sole government agency responsible for regional economic development, DREE (now DRIE) was unable to manage its massive case load, causing delays in the approval and implementation of development projects. In 1987, the Mulroney government dismantled DRIE and established three separate regional development agencies for the Atlantic, western, and central provinces. Mulroney hoped that this new, decentralized system of regional development

would be more efficient than the one created by Trudeau. This initiative was part of Mulroney's larger political project, which sought to modernize the unwieldy bureaucracy of the federal government and reduce the distance between federal civil servants and the people they serve (Savoie, 1994; Bryden, 2007b).

In 1986, the provincial government of Ontario introduced the first systematic innovation network program in Canada, the Ontario Centres of Excellence (OCE) program. The purpose of this program was to strengthen Ontario's high-tech industries by establishing a series of collaborative research networks throughout the province (Bell, 1996). Federal policymakers worried that, if Ontario's high-tech industries developed quickly under the OCE program, then entrepreneurs, academics, and scientists throughout Canada would gravitate to Ontario. This would reinforce Ontario's economic dominance, thus exacerbating regional economic inequality. To prevent Ontario from monopolizing Canada's human resources, draining other provinces of their most innovative people, the federal government introduced its own innovation network program: the Networks of Centres of Excellence (NCE) program (Fisher, Atkinson-Grosjean & House, 2001, p310). By funding virtual innovation networks across Canada, the NCE program allowed every province and region to develop stronger scientific and technological capacities. A 2004 report from the federal granting councils shows the national distribution of NCE partner organizations—that is, organizations which are embedded in NCE-funded innovation networks—between the years 1996 and 2000 (Networks of Centres of Excellence, 2004, p13). According to the report, NCE partner organizations exist in every province from coast to coast, including those with low populations and less developed economies, such as New Brunswick, Nova Scotia, and Newfoundland. The NCE program thus creates opportunities for organizations in less developed provinces to join innovation networks, which increases their access to scientific

knowledge and raises their level technological proficiency. This in turn helps less developed provinces transition from traditional industries, such as agriculture and fishing, to high-tech industries, such as telecommunications and medical research. One could argue, in fact, that the NCE program is partly a regional development program, continuing the mission of the Department of Regional Economic Expansion. Another federal network program which assists less developed provinces is the Genome Canada program. As we saw in the introductory chapter, Genome Canada is a federal agency which oversees five ‘regional centres’ —Genome Ontario, Genome Quebec, Genome BC, Genome Prairie, and Genome Atlantic (Doern, Castle & Phillips, 2016, p305). Each regional centre secures funding for virtual innovation networks in a different part of Canada, allowing scientists and researchers throughout the country to engage in collaborative genomics research. Two of these centres—Genome Prairie and Genome Atlantic—help fund networks in less developed provinces, many of which focus on agricultural science, sustainable fishing, and viral diseases.

Since the late 1980s, the federal government has launched many innovation network programs. In addition to the NCE program and Genome Canada program, the federal government has created innovation networks through the Natural Sciences and Engineering Research Council, the Canadian Institutes of Health Research, and more recently the Innovation Supercluster Initiative. Canadian political scientists have identified these programs as the most important innovation network programs at the federal level (Fisher, Atkinson-Grosjean & House, 2001, p299; Sa & Litwin, 2011, p430; Doern, Castle & Phillips, 2016, p176; Doloreux & Shearmur, 2018). All of these network programs are designed to bring firms, universities, and research institutions together virtually. This raises an important question: why does the federal government seem to support virtual networks instead of anchored networks? There are two

answers to this question. First, in order to promote regional economic equality, the federal government seeks to create innovation networks in all parts of Canada, from the urban centres along the southern border to the small towns on the east coast. Given its budgetary constraints, however, the federal government cannot afford to create anchored networks throughout the country, as this would require the funding of dozens of new science parks, technology incubators, and communal research centres. The only way for the federal government to achieve the national proliferation of innovation networks (without going into massive debt or draining the national treasury) is by creating virtual networks. Second, since virtual networks are based on remote forms of communication, they have the ability to link firms, universities, and research institutions that are situated far apart geographically. In fact, they can link innovative organizations that are located in completely different provinces. This allows innovative organizations in underperforming provinces, such as New Brunswick and Manitoba, to access scientific knowledge and other resources in high-performing provinces, such as Ontario and Quebec. The flow of resources from high-performing to underperforming provinces can help close inter-provincial economic gaps. Of course, organizations in *all* provinces can become more productive and innovative by engaging in collaboration and knowledge-sharing across provincial/regional boundaries. This idea has its roots in innovation systems theory, which has long recognized the economic benefits of inter-regional knowledge flows. According to some innovation systems scholars, the exchange of scientific and technical knowledge between organizations in different regions contributes significantly to regional economic development (Huggins & Thompson, 2014). Going further, these scholars suggest that knowledge flows *across* regions provide a greater stimulus to innovation and economic growth than those *within* regions (Weterings & Ponds, 2009).

As we saw in the introductory chapter, the global economy underwent radical changes in the 1980s and 1990s as a result of trade liberalization, the emergence of information technologies, and other factors (Levy, 1995; Rao, 2001, p572; Wacziarg & Welch, 2008, p187). As these changes unfolded, national governments abandoned many of the industrial policies of the 1960s—such as import substitution—and adopted a new set of industrial policies that were better suited to a globally-interconnected economy (Srinivasan & Tendulkar, 2003; McMichael, 2008; Sharaput, 2010). According to some scholars, policies which promote regional economic equality were among the many ‘classic industrial policies’ consigned to history during this time. In his book *New State Spaces*, Neil Brenner argues that since the 1980s, national governments have not carried out any regional development policies aimed at raising the economic status of poor or underdeveloped regions. Instead, they have carried out ‘pro growth’ policies aimed at enhancing the economic performance of already-competitive regions—that is, regions which are already integrated into circuits of global capital:

“During the 1960s, most western European states established relatively uniform, standardized administrative structures throughout their territories and mobilized redistributive spatial policies designed to alleviate intra-national territorial inequalities by extending urban industrial growth into underdeveloped, peripheral regions. This project of spatial Keynesianism continued into the 1970s, but was widely abandoned during the subsequent decade, as policymakers became increasingly preoccupied with the challenges of urban industrial decline, welfare state retrenchment, European integration, and economic globalization...As of the early 1980s, national states began to introduce new, post-Keynesian spatial policies intended to re-concentrate productive capacities and specialized, high-performance infrastructural investments into the most globally competitive city-regions within their territories” (Brenner, 2004, p2).

The statement above applies not only to national governments in western Europe, but to those all over the world. In an age of economic globalization and neoliberalism, Brenner argues, all national governments have given up their commitment to regional economic equality. In Canada, however, the federal government never stopped fighting against regional economic disparities.

As we have seen, the innovation network policies carried out by the federal government in the 1990s and beyond were designed to both strengthen Canada's high-performing provinces and modernize the country's underperforming provinces. The ongoing support of the federal government for regional economic equality poses a challenge to political economic theorists, like Brenner, who believe in a fundamental reorientation of 'state spatial policy'.

Explaining the Federal Government's Commitment to Regional Economic Balance

While some national governments may have abandoned 'redistributive spatial policies' in the 1980s and 1990s (Petach, 2021), this was not the case with the Canadian federal government. To understand why, we must delve into Canada's political and economic history. Since Confederation, Canada has been plagued by inter-regional and inter-provincial conflicts, many of which have been fuelled by economic disparities and grievances. Sometimes, these conflicts have destabilized national politics and placed tremendous strain on Canada's federal institutions. One such conflict was that between Canada's western and central provinces throughout the twentieth century. At the heart of this conflict was the economic exploitation of the western provinces (British Columbia, Alberta, Saskatchewan, and Manitoba) by the central provinces (Ontario and Quebec). In the early twentieth century, most people in the western provinces were employed in agriculture, with many growing wheat and other grains on small homestead farms. While some of these grains were consumed domestically, most were exported to Europe. In order to access European markets, western farmers had to rely on transportation and marketing systems that were controlled by capitalists in Ontario and Quebec. These capitalists often charged exorbitant fees for their services, which hurt the livelihoods and economic prospects of western farmers (Loleen & Gibbins, 2014, p7). In addition, many western farmers owed debts to central Canadian financiers—debts which they often had difficulty repaying. During the Great Depression of the

1930s, a large number of western farmers defaulted on their debts and were forced to abandon their farms. Under these dismal economic conditions, people in the western provinces came to view Ontario and Quebec with contempt, blaming their economic misfortunes on the machinations of central Canadian bankers and industrialists. A number of populist political parties emerged in western Canada which sought to protect western economic interests from central Canadian rapaciousness. One of these parties, the Social Credit Party of Alberta, tried to reduce the power of central Canadian banks in western Canada by creating its own currency system—an initiative which was deemed unconstitutional by the Supreme Court in 1938 (Finkel, 1989, p42). Other populist parties which arose during this period were the United Farmers of Alberta, the Progressive Party of Canada, and the Cooperative Commonwealth Federation, whose ideologies and priorities departed significantly from those of the established Liberal and Conservative parties.

In the mid-1940s, substantial oil reserves were discovered in Alberta and Saskatchewan. Over the next two decades, a large oil industry developed in these provinces, as oil companies began extracting and exporting thousands of barrels of oil per day. When the price of oil soared in the 1970s, oil revenues in Alberta and Saskatchewan exploded, generating massive economic growth (especially in Alberta) (MacFayden & Watkins, 2014, p420). In 1980, the federal government introduced the National Energy Program (NEP), which imposed special taxes and price controls on the oil industry in western Canada, and greatly expanded PetroCan, an oil company owned by the federal government (Leslie, 1987). The goal of this program was to lower the price of oil and gas for consumers across Canada and increase the federal government's share of oil revenue. People in Alberta and Saskatchewan viewed the NEP as a direct attack on their economic interests, because it reduced the profits of the oil industry in western Canada, causing a

significant slowdown in oil exploration and development. In an effort to maintain the profitability of the oil industry, the provincial governments of Alberta and Saskatchewan lowered provincial taxes on oil. As provincial tax revenues declined, however, these governments faced mounting fiscal and budgetary pressures. To many western observers, the NEP appeared to serve the interests of Ontario and Quebec, which both stood to benefit from the lowering of energy costs and the redistribution of western Canada's oil wealth. Between 1980 and 1984, western politicians carried out an aggressive campaign to dismantle the NEP, with the Premier of Alberta challenging the legality of the federal government's new oil taxes (Sweeny, 2010, p110-115). Once the NEP was eliminated in 1985, these politicians created their own federal political party—the Reform Party of Canada—in an effort to increase western representation in federal government. The Reform Party was supposed to function as a counterbalance to the Liberal and Progressive Conservative parties, both of which were beholden to central Canada and supported 'anti-western' policies, like the NEP (Bright, 2002, p49). During its ten years as an active party, the Reform Party not only promoted policies favourable to western Canada, but also sought to empower western MPs by changing federal parliamentary rules and procedures (Smith, 2009). In 2004, the Reform Party (under its new name, Canadian Alliance) merged with the Progressive Conservative Party to form the modern day Conservative Party of Canada. Given its pedigree, the Conservative Party of Canada is somewhat oriented towards western interests.

Like the western provinces, the Maritime provinces have had many economic grievances against central Canada. These grievances began in the late nineteenth century, when manufacturing industries in the Maritime provinces were forced to shut down, unable to compete with industries in Ontario and Quebec. At the same time, financial institutions in the Maritime provinces relocated their operations to central Canada, where the amount of available investment

capital was much higher. As industrial and financial activity disappeared from the Maritime provinces, this region was turned into an agrarian hinterland, condemned to exist in the economic shadow of the central Canadian metropole. In 1919, the federal government seized control of the Intercolonial Railway, a 1,100 km railway which connected the Maritime provinces to Quebec. Up to this point, the Intercolonial Railway was managed by the Maritime provinces, with its headquarters located in the city of Moncton, New Brunswick. After its takeover by the federal government, the Intercolonial Railway was integrated into the Canadian National Railway, and its headquarters was moved from Moncton to Toronto. This was followed by an increase in freight rates, which caused economic hardships for Maritime farmers and fishermen. According to Ernest Forbes, Canada's preeminent Maritime historian, people in the Maritime provinces saw the loss of the Intercolonial Railway as a potent reminder of their region's economic decline, and of central Canada's economic domination (Forbes, 1979, p26). Angered by this situation, politicians in the three Maritime provinces came together to form a 'Maritime rights movement'. Throughout the 1920s, this movement engaged in mass political agitation against the federal government, demanding that the federal government grant the Maritime provinces increased subsidies, lower freight rates and tariffs, and restored control over the Intercolonial Railway. Some radical members of this movement believed that the federal government should decentralize fiscal powers to the provinces, which would allow the Maritime provinces to set their own tariffs. Others believed that the Maritime provinces had gained nothing from Confederation, and should secede from Canada. In response to this movement, the federal government convened a royal commission to investigate the major economic problems in the Maritime provinces, and propose solutions to these problems.

In contrast with the Maritime provinces, Quebec enjoyed a privileged economic position throughout the late nineteenth century and early twentieth century. Harnessing its abundant natural resources, including cheap hydro-electric power, Quebec was able to develop robust agricultural, mining, manufacturing, and financial sectors. The benefits of economic and industrial development were not evenly distributed throughout Quebec society, however. French-speaking people, who constituted the majority of Quebec's population, were generally relegated to low-skilled and low-wage jobs, with little opportunity for upward economic mobility. Meanwhile, English-speaking people had access to high-status and high-paying jobs, including managerial and executive jobs, allowing them to not only accumulate wealth, but also control the 'commanding heights' of Quebec's economy (McRoberts, 2000, p67-70). The economic gap between French-speaking and English-speaking Quebecers persisted throughout the first half of the twentieth century. By the mid-1950s, French-speakers had become extremely frustrated with their economic situation. Many were resentful toward the small English-speaking elite, which virtually monopolized the province's economic resources. This resentment eventually gave rise to French economic nationalism, a popular ideology which sought to bring Quebec's economy under French control. As we saw in Chapter 2, this ideology was fully embraced by the provincial government of Quebec in the 1960s and 1970s (Fournier, 1978). Of course, French economic nationalism was accompanied by other forms of nationalism, including cultural and political nationalism. French cultural nationalism sought to strengthen French linguistic rights and cultural institutions, while French political nationalism sought to increase Quebec's political autonomy within Canada (Rocher, 2013). In its most extreme form, political nationalism aimed to transform Quebec into a sovereign country, completely severing Quebec from 'English Canada'.

As the historical exposition above shows, regional economic grievances in Canada have given rise to regional political movements seeking redress for these grievances. In western Canada, a widespread feeling of economic exploitation and unfairness led to the emergence of populist political parties, such as the Social Credit Party, Cooperative Commonwealth Federation, and Reform Party. These parties were not marginal actors in the Canadian political scene, but exercised real influence, challenging established political norms and shifting the balance of political power in the Canadian federation. In the Maritimes, decades of economic decline and stagnation compelled the leaders of Nova Scotia, New Brunswick, and Prince Edward Island to engage in collective political protest. Although the Maritime rights movement was not nearly as influential as its western counterpart, it was able to place Maritime needs on the federal political agenda, and raise the level of regional consciousness in the Maritimes (Forbes, 1979, p191). Finally, in Quebec, economic inequities between French-speakers and English-speakers created the conditions for French nationalism to emerge. All of these regional movements for economic justice shocked the Canadian political establishment, changing the outlook of federal policymakers and elected officials. They showed the federal government that regional economic grievances and disparities can have deep, far-flung, and long-lasting political consequences. Whenever a region in Canada experiences economic difficulties, the federal government fears that this may lead to regional political unrest and protest (as well as inter-regional conflict), threatening the integrity of federal institutions. In order to prevent large-scale political crises, the federal government strives to ensure that *all* provinces and regions are economically prosperous.

At the risk oversimplification, one could say that the Canadian federal government remains committed to regional economic balance for two reasons. The first reason, as we have

seen, has to do with Canada's history of economically-motivated regional protest and conflict. The second reason, not yet discussed, has to do with federal voting behaviour and the logic of electoral politics in Canada. In his 2002 study, Fred Cutler found that federal voting behaviour is heavily influenced by local economic conditions—in other words, Canadians decide which federal party to vote for based on the economic status of their locality or region (Cutler, 2002). If a person's area is performing well economically, then they are likely to vote for the incumbent party. Conversely, if a person's area is struggling economically, then they are likely to vote for an opposition party (even if they are personally doing well). Cutler made this discovery by systematically comparing electoral data and unemployment statistics in different cities and 'sub-provincial regions' across Canada. The implications of Cutler's study are profound: in order to remain in power, the incumbent party must support policies that benefit the economies of all regions, especially lagging or less developed regions. If the incumbent party ignores the economic suffering of a particular region, then it will be electorally punished by the residents of that region. This means that it is in the political interest of the incumbent party, regardless of its ideological orientation, to maintain regional economic balance, at least to a certain degree. It should be noted that Cutler is just one of many political scientists who have demonstrated the regional character of Canadian electoral politics. Since the 1960s, political scientists have argued that Canadian voters are exceptionally regional-minded, as they tend to support parties that speak to the needs and concerns of the regions where they live (Alford, 1963; Englemann & Schwartz, 1967; Pammett, 1987; Brodie, 1990). This makes voters in Canada quite different from those in other western industrialized countries, who are more concerned with class-based issues than regional issues. According to Richard Simeon and David Elkins, two pioneering Canadian political scientists, regionalism does not just shape elections in Canada, but permeates all aspects

of Canadian politics: “Canadian politics is regional politics; regionalism is one of the pre-eminent facts of Canadian life, whether reflected in the principles of cabinet-building, the acrimony of federal-provincial conferences, or the virtual elimination of class voting on at least a national scale” (Simeon & Elkins, 1974, p397).

City Branding and Anchored Networks

Since the advent of economic globalization in the 1980s and 1990s, cities all over the world have faced a number of economic challenges. In Europe and North America, cities have experienced deindustrialization—that is, the rapid disappearance of manufacturing industries—causing major losses in employment and problems of economic adjustment (Bourne, 1991). At the same time, these cities have been exposed to global economic competition as a result of trade liberalization, advancements in information technology, and the economic ascendance of Asia. In order to maintain their economic vitality, these cities have had to attract investment, technology, skilled workers, entrepreneurs, and tourists from around the world (Florida, 2002). This has required that they increase their visibility on the world stage, typically by marketing or branding themselves as ‘global cities’. A global city can be defined as a city that caters to the needs of the global economic elite, and has achieved the highest standards of livability, comfort, prosperity, creativity, and cultural refinement. Most city branding efforts involve the creation of new infrastructure and amenities, often called ‘megaprojects’, such as transit systems, parks, museums, convention centres, concert venues, and upscale housing and retail complexes (Ren, 2008; Kennedy, 2015). Megaprojects are often supported and funded by a combination of actors and organizations, including municipal governments, regional or provincial governments, local business associations, private housing developers, nonprofit organizations, and foreign investors.

It is not just cities in Europe and North America that have sought to achieve ‘global city status’ by changing and improving their built environments. All across Asia, cities have invested billions of dollars into megaprojects in an effort to prove that they are ‘worthy’ of global attention and investment. For example, in 2002, the city of Delhi invested \$2.2 billion to create a new metro system equipped with high-tech trains and underground stations. In his article titled *Message in a Metro*, Matti Siemiatycki describes the Delhi metro in detail, and explains how it functions as a branding tool for the city:

“Inside the metro stations, aesthetics that include an open concept layout, technologically advanced no-touch turnstiles, security cameras, and well-appointed station trimmings project an image of progress, order, cleanliness, and security. The silver trains with their sleek industrial design, automatic doors, digital signs, and climate control are a tangible embodiment of the future. While life outside the station walls may be uncivil, aggressive, and crowded, inside behaviour is calm, unthreatening, and comfortable. This is the vision for a modern Delhi, as promoted by the politicians and technocrats leading the development of the metro in their media sound bites and inauguration speeches...With its ultra-modern technology and visually striking design, officials in Delhi have used the metro to stake a claim as a ‘world class city’ that is ready to compete for attention and investment in the global economy” (Siemiatycki, 2006, p285).

As the example of the Delhi metro shows, design and aesthetics are a very important part of megaprojects. In order to impress global observers (especially potential investors and expatriates), megaprojects must not only serve a practical purpose, but also create a rarefied aura of beauty and sophistication. Many megaprojects around the world have interesting architectural and stylistic features that are intended to mesmerize and inspire awe in onlookers, especially foreigners. This is the case with megaprojects in Beijing, which often combine traditional Chinese and international architectural styles, giving them an eclectic quality that is quite compelling. According to Xufei Ren, a sociologist specializing in Chinese urbanization, most megaprojects in Beijing are designed by world-renowned architects from Europe and North America, who often include futuristic and non-Chinese elements in their designs. By exhibiting

‘hyper-modern’ design features, these megaprojects help “reorient the image of Beijing from a dusty post-socialist city to an international metropolis with a vibrant architectural scene” (Ren, 2008, p521).

Since the mid-1990s, some megaprojects have taken the form of ‘technopoles’ — that is, high-tech campuses where entrepreneurs, researchers, and venture capitalists meet and work together on innovative endeavours. Technopoles often contain different buildings and facilities that serve the needs of innovators, such as offices, co-working spaces, communal research laboratories, multimedia studios, and business accelerators. They also may contain well-manicured gardens, upscale restaurants, and recreational spaces, which create a relaxed atmosphere that is supposedly conducive to creativity. Like other megaprojects, technopoles feature unique and forward-thinking architecture; many buildings on technopole campuses are futuristic and innovative, with some having an almost extraterrestrial visual quality. Since 2000, scholars have studied the rise of technopoles in a number of cities, including Melbourne (Yigitcanlar, O’Connor & Waterman, 2008), Kuala Lumpur (Brooker, 2013), Enschede (Benneworth & Ratinho, 2014), and New York City (Zukin, 2020). In each of these cities, municipal governments worked with local businesses and universities to create campuses that would bring innovators together, accelerate scientific and technological discovery, and spawn new high-tech companies. Once these campuses were established, they were used as marketing or branding tools. Each city claimed that, by possessing a technopole, it had become a ‘knowledge city’ or ‘science city’ — a city that is at the forefront of scientific and technological development. The existence of a technopole allowed each city to position itself, at least rhetorically, within the new ‘knowledge economy’ or ‘information economy’.

In Canada, many cities have attempted to rebrand themselves and adapt to changing economic conditions by creating megaprojects. For example, at the turn of the millennium, the city of Toronto started creating a ‘cultural and recreational hub’ on its waterfront, complete with art galleries, creative studio spaces, parks, and an aquarium (Laidley, 2006). Municipal officials claimed that this hub would enhance Toronto’s economic competitiveness, attract ‘creative workers’ to the city, and allow the city to successfully bid for the Olympics (Lehrer & Laidley, 2009). Another notable megaproject in Toronto is the MaRS Centre, a massive building situated in the downtown core of the city that houses tech companies, research institutions, and venture capitalists. With 1.5 million square feet of space and 150 tenants, the MaRS Centre is Canada’s largest technopole and innovation centre (MaRS, 2018). Inside the MaRS Centre, there are separate offices for tenants, auditoriums and event spaces, communal laboratories, a biotechnology business incubator, and an impressive atrium with a 62 foot high glass ceiling. The building is laced with advanced communication technologies, including a robust fibre optic network, powerful multimedia server, and integrated communication portal (Parsons, 2006). All of these technologies allow tenants to easily exchange data and information with each other, thus creating the conditions for a vibrant ‘innovation ecosystem’. Since its founding in 2005, the MaRS Centre has received international attention for its massive size, its ‘smart’ physical design, and its ability to support successful ventures. Every year, the MaRS Centre is visited by hundreds of foreign officials, entrepreneurs, and venture capitalists:

“With an international reputation as a leading innovation hub, MaRS entices over 200 international delegations of innovators, investors, and governments annually. These delegations visit, eager to learn more about how MaRS supports the Toronto and Canadian tech ecosystem and to meet the ventures that reside within it” (MaRS, 2018, p28).

By hosting such delegations, the MaRS Centre helps Toronto market itself on the world stage as a high-tech city. In 2006, the MaRS Centre was named the ‘Intelligent Building of the Year’ by the Intelligent Community Forum, a nonprofit organization that recognizes and awards creative uses of information technology around the world.

While all megaprojects are expensive to create, technopoles are especially costly, because they require buildings that can accommodate a range of different innovative activities. These buildings must be outfitted with state-of-the-art research equipment and information technology, as well as spaces for individual and collaborative research, events, dining, and recreation. They must also be staffed by professionals who can assist tenants with their innovative challenges, and shepherd them through the innovative process. Given their exorbitant cost, technopoles cannot be created by municipal governments by themselves, as these governments have limited resources and fiscal capacities (municipal governments do not have access to income tax revenue). Even with the financial support of local businesses, or of coalitions of prominent local actors, municipal governments cannot afford to pay for technopole-related infrastructure and personnel. Oftentimes, cities can only create technopoles if they receive financial assistance from regional-level governments. This is the case in Canada, where many cities have received money from provincial governments to build, maintain, and expand technopoles. For example, in the early 2000s, community and business leaders in Toronto received a \$45 million grant from the government of Ontario to construct the MaRS Centre (Office of the Premier, 2005). Without this grant, the MaRS Centre would not have become a reality. In 2007, just two years after opening its doors, the MaRS Centre began the process of expanding by constructing a new research tower. During the Great Recession of 2008/09, however, the MaRS Centre was forced to pause its expansion due to a lack of funds. To allow the expansion to continue, the Ontario government

gave the MaRS Centre a massive \$224 million loan through Infrastructure Ontario and the Ministry of Research and Innovation (Nobrega & Stephenson, 2014). While the MaRS Centre has received some funding from the Canadian federal government, its main financial benefactor has been the provincial government of Ontario.

Whenever provincial governments have funded technopoles in cities, they have usually done so under pressure from urban political and economic elites, such as municipal officials, business leaders, and community leaders. Through their vigorous and concerted lobbying efforts, these elites have convinced provincial governments that technopoles are essential to the economic growth and prosperity of cities. Again, we may look at the MaRS Centre as an example. In the early 2000s, the MaRS Centre was able to obtain ‘seed’ funding from the provincial government because it was actively promoted by prominent Toronto-based organizations, including the University of Toronto and the University Health Network (Canada Newswire, 2001). Equally important, the MaRS Centre was supported by highly-respected, influential, and well-connected individuals from the worlds of business and academia. The first Chairman of MaRS, John Evans, also served as Chairman of Torstar Corporation, a large media corporation that owns The Toronto Star. Similarly, the first CEO of MaRS, Ilse Treurnicht, was previously the CEO of Primaxis, a company that produces information management systems for healthcare providers (Steed, 2005). Treurnicht was also married to David Naylor, the president of the University of Toronto at the time. Using their extensive connections, these elite actors were able to lobby the government of Ontario to support MaRS financially. It is important to note that technopoles are essentially innovation networks, as they bring entrepreneurs, academics, and other actors together within the same physical space, where they collaborate on innovative projects. To use the terminology introduced in the introductory chapter, technopoles are anchored

innovation networks. By funding the construction and expansion of technopoles, provincial governments can achieve two different goals. First, they can create the conditions for innovative individuals to engage in face-to-face interaction and collaboration. Second, they can help cities attract attention, talent, and investment, thereby satisfying the demands of urban political and economic elites.

Municipal-Provincial Relations and Anchored Networks

The previous section suggested that, since the early 1990s, provincial governments have funded technopoles in the various cities they preside over, usually under pressure from urban economic and political elites. Over time, technopoles have become integral to innovation network policy at the provincial level. In this section, we will investigate why urban elites have been so successful in securing provincial funding for technopoles, and why provincial governments have been so eager to satisfy these elites. In order to answer these questions, we must turn our attention towards municipal-provincial relations in Canada, which have changed significantly since the 1980s. We must also understand the relationship between globalization, urban economic consolidation, and urban political aggrandizement in a Canadian context. As we will see, Canadian cities have gained considerable political power in relation to provincial governments due to broad changes in the global economy.

In the mid-1990s, a number of economists and economic geographers argued that, as economic globalization and technological development progressed, cities would lose their economic power and significance. This argument was most notably made by Francis Cairncross, a British economist and journalist, in her controversial book *The Death of Distance* (Cairncross, 1997). The central thesis of this book is that new information and communication technologies, in particular personal computers and the internet, allow enterprises to interact with suppliers,

customers, and investors located hundreds or even thousands of kilometres away. As a result, it is no longer necessary for enterprises to be physically located in cities, where suppliers, customers, and investors are spatially proximate. As enterprises establish their operations in non-urban areas, Cairncross argued, cities will inevitably experience economic decline. This theory has been challenged on both empirical and conceptual grounds by a number of scholars since the 2000s. For example, Neil Bradford and Alison Bramwell have argued that, in spite of globalization and technological advancement, cities continue to grow in population and wealth, and continue to function as critical economic junctures. In fact, the economic strength of cities has increased dramatically since the advent of globalization:

“The burst of techno-enthusiasm that initially accompanied globalization and the information technology revolution led many observers to predict the ‘end of geography’ and the ‘death of distance’. Yet, urbanization continues to accelerate around the world even as business operates on a global scale and people migrate across borders. It is a ‘paradox of globalization’ that cities have become more rather than less important as sites of production and distribution” (Bradford & Bramwell, 2014, p7).

Saskia Sassen, a sociologist known for coining the term ‘global city’, also associates globalization with the growth and empowerment of cities. In her article titled *Territory and Territoriality in the Global Economy*, Sassen explains how modern corporations have established global supply chains and distribution networks spanning multiple countries and involving hundreds of subsidiaries, partners, and affiliates (Sassen, 2000). In order to manage these complex global systems, corporations have employed large numbers of management professionals, including logistics managers, quality control managers, purchasing managers, accountants, and IT specialists. They have also solicited the services of business support firms, which help them understand and navigate the financial, legal, and cultural systems of different countries. According to Sassen, most management professionals live and work in cities, where they have access to the cultural and lifestyle amenities desired by high-income individuals. At

the same time, most business support firms locate their operations in cities, where they are situated close to the headquarters of multinational corporations. As corporations have become global in scale, therefore, cities have become the sites of important economic activity.

Sassen's theory of urban economic growth and empowerment can easily be applied to Canada, where cities flourished economically during a time of global economic integration. Throughout the 1980s and 1990s, as Canada became embedded in the global economy, multinational corporations established headquarters and branch offices in Canada's cities. Around the same time, business support firms rapidly emerged and grew in these cities, especially in large metropolitan areas. While some business support firms served small and medium-sized Canadian enterprises, many served multinational corporations, assisting them with financial, legal, marketing, and logistics matters. According to William Coffey and Richard Shearmur, the number of business support firms in Canada almost tripled over the 1980s, with most new firms being created in large cities (Coffey & Shearmur, 1997). As Canada's cities experienced these economic changes, they began to attract more foreign and domestic migrants, which greatly accelerated the growth of Canada's urban population. While population growth occurred in all cities across the country, it was most notable in those cities located in the Greater Golden Horseshoe Area (in southern Ontario), Greater Montreal Area, Ottawa-Gatineau Corridor, Vancouver-Victoria Corridor, and Calgary-Edmonton Corridor (Newbold, 2011).

With the economic modernization and demographic growth of Canada's cities, the power dynamic between cities and provincial governments changed. By leveraging their economic strength and mobilizing their large populations, cities were able to engage in 'policy battles' with provincial governments, pressuring these governments to adopt policies and programs favourable to them. For example, in 2004, the city of Toronto convinced the provincial government of

Ontario to restore funding for public transit by carrying out a large-scale, multi-stakeholder campaign. This campaign was led by the municipal government of Toronto and supported by various local organizations, including the Toronto Board of Trade and City Summit Alliance, two advocacy groups representing Toronto's increasingly powerful business community (Horak, 2012, p236). Similarly, in 2007, the city of Calgary entered into a bitter conflict with the provincial government of Alberta over infrastructure, with the city demanding greater provincial funding for roads, recreational facilities, and a light rail system. The Alberta government eventually acquiesced to Calgary's demands, granting the city \$3.3 billion for new infrastructure over a ten-year period. Calgary was able to extract this concession from the Alberta government because its economy and population had grown substantially over the previous decade, giving it considerable power in inter-governmental relations (Miller & Smart, 2012, p31). The Premier of Alberta, Ed Stelmach, realized that if he rejected Calgary's demands, then he would lose electoral support in Alberta's most populous city, possibly ruining his reelection prospects.

Throughout most of Canada's history, municipal governments were passive actors in the Canadian political arena. As 'creatures of the provinces', municipal governments were not allowed to formulate their own policies or carry out their own initiatives, as their only function was to "deliver services efficiently and keep property taxes low" (Siegel, 2009, p21). As cities experienced rapid economic and population growth in the 1990s, however, municipal governments became interested in assuming an active policymaking and governance role. In 2001, the mayors of Toronto, Montreal, Vancouver, Calgary, and Winnipeg formed an alliance to demand greater autonomy, power, and financial resources for municipal governments (Keil & Young, 2003, p89). A similar demand was made by municipal associations across Canada, including the Association of Municipalities of Ontario, Union of British Columbia

Municipalities, and Federation of Canadian Municipalities. Faced with widespread municipal political agitation, provincial governments decided to enhance the policymaking authority of municipal governments by changing their municipal statutory laws. In Ontario, the provincial government introduced a new municipal charter, the 2003 Municipal Act, which recognized that municipal governments have various ‘spheres of jurisdiction’, such as waste disposal, housing, parks, and economic development. Under the new charter, municipal governments enjoy total freedom of action within these spheres of jurisdiction—they can plan and implement projects without being subject to provincial scrutiny or requiring provincial approval (Siegel, 2009). A similar framework was introduced in Alberta, Saskatchewan, Manitoba, and Quebec. It should be noted that Toronto was granted its own special charter in recognition of its unique size and economic significance. In British Columbia and Nova Scotia, municipal governments were not granted ‘spheres of jurisdiction’, but their legal status was changed from ‘provincial corporations’ to ‘orders of government’. This new legal designation allowed them to set their own goals and establish new sources of revenue (Garcea, 2014, p89).

To summarize the foregoing discussion, municipal governments have become formidable and effective political actors over the last few decades as a result of broad economic, demographic, and legal changes. Rather than deferring to provincial governments on all policy matters, municipal governments now develop and implement their own policies, and oppose or resist provincial policies that they disagree with. Also, rather than managing local affairs in a highly circumscribed manner, municipal governments now exercise managerial flexibility and autonomy. Provincial governments no longer view municipal governments as ‘passive creatures’ or ‘service delivery agents’, but as partners in the policymaking process. It is now common for provincial governments to consult with municipal governments and local stakeholders before

carrying out major policy initiatives. Under these conditions, municipal governments can easily lobby provincial governments for technopole funding, especially if they have the support of local businesses and community organizations.

Explaining the Policy Divergence: Geopolitics or Institutions?

This chapter sought to elucidate the geopolitical and geoeconomic forces that may cause Canada's federal and provincial governments to adopt different innovation network strategies, or to create different types of innovation network. The beginning of the chapter showed how, since the 1960s, the federal government has been committed to promoting regional economic balance, recognizing that regional economic disparities give rise to political conflict and instability. By helping create *virtual* innovation networks from coast to coast, it was argued, the federal government hoped to stimulate economic growth and development in every region and province of Canada, and to ensure that the benefits of the knowledge economy (and the high-tech economy) are evenly spread throughout the country. Later in the chapter, it was shown how Canadian cities have grown in population and economic strength since the 1980s, allowing them to gain greater political power and autonomy. Cities have used this new political power, it was suggested, to lobby provincial governments to fund science parks, communal research laboratories, business incubators and accelerators, and other 'technopoles' within their jurisdictions. Technopoles are highly desired by cities because they function as powerful branding or marketing tools in the global economy. As provincial governments have funded the construction and expansion of technopoles, they have made these facilities the centrepiece of their innovation network strategies.

Up to this point, this dissertation has put forward two propositions. The first is that Canada's federal and provincial governments seek to create different types of innovation

network. The second is that these governments pursue different innovation network strategies because they are subject to different geopolitical and geoeconomic forces. According to this view, innovation network policy in Canada is heavily influenced by broad social, economic, and political forces—namely, globalization, urbanization, regional political unrest, and municipal lobbying. Many political scientists have argued, however, that public policy is not only influenced by broad societal forces, but also by the institutional mechanisms of government, including organizational structures, formal bureaucratic rules, and informal policymaking conventions (March & Olsen, 1984; Skocpol, 1985; Caporaso & Levine, 1992, p182).

Organizing under the intellectual banner of ‘new institutionalism’, these political scientists assert that all policymaking bodies (cabinets, legislatures, government ministries) have their own norms, traditions, and ‘collective memories’, which partly determine how they identify and solve public policy issues. Whenever these bodies seek to create and implement new public policies, they draw lessons from their own experiences—their own policy successes and failures. Sometimes, public policies that were effective in the past are modified and updated for the present. To use the terminology of new institutionalism, the policymaking process typically follows a particular path or trajectory, one that is historically and institutionally determined. This process is ‘path dependent’:

“In public policy research, the notion of path dependence is associated with the surge of new institutionalism that tends to define path dependence as a situation where the present policy choice is constrained or shaped by institutional paths that result from choices made in the past. In other words, the possibility of reforming public policy depends on institutionalized legacies that structure our perceptions of problems and goals, define the range of appropriate and feasible options, and determine the costs and benefits of policy changes” (Torfing, 2009, p71).

The idea of path dependency suggests that public policy decisions are influenced or informed by existing institutional knowledge and memory. This does not mean, however, that policy decisions

are preordained, nor does it mean that policymakers *must* follow the institutionally-determined path of policy development. To the contrary, policymakers can deviate from this path and pursue radically new policy options, but only if they can overcome institutional inertia, historical baggage, and stakeholder resistance. Path dependency is an obstacle to policy innovation and experimentation that can be surmounted with enough effort and will.

Canada's federal and provincial governments have different institutional structures and memories, governance traditions, and policy histories. If these governments adopt different innovation network policies, this may be explained by their institutional and historical differences, not by their different geopolitical conditions (as hypothesized above). For example, federal and provincial governments may embrace innovation network policies that reflect (and build upon) their different industrial policy experiences, which is consistent with the notion of path dependency. Part of this dissertation thus seeks to determine whether federal and provincial decisions about innovation network policy are shaped more by historical/institutional factors (industrial policy history, systems of governance) or geopolitical and geoeconomic factors (intergovernmental relations, regional conflict, urbanization). The next chapter elucidates the different governance practices and industrial policy histories of the federal, Ontario, and Alberta governments.

Chapter 5: Canadian Governance and Industrial Policy History

The aim of this dissertation, as explained in the introductory chapter, is to compare federal and provincial innovation network policies and programs in Canada since the 1980s. For both practical and methodological reasons, only two provinces are being taken into consideration: Ontario and Alberta. Before examining the innovation network initiatives carried out by federal and provincial governments, of which there are many, we must first venture into the realm of political and economic history. In particular, we must look at how the federal, Ontario, and Alberta governments have sought to promote industrialization, economic independence, and economic growth over the decades. We must also look at how these governments have shaped their political institutions and systems of governance. This historical exposition will begin in the late nineteenth century and end in the early twenty-first century. The present chapter consists of four sections. The first three sections discuss the industrial policies and governance systems of the federal government, Ontario government, and Alberta government. The fourth section briefly compares and contrasts the industrial policies and governance systems of these three governments, and draws general conclusions.

Governance and Industrial Policy at the Federal Level

Soon after Canada became a country in 1867, the federal government launched a strategy of national economic development. John A. Macdonald, who was Canada's first Prime Minister, wished Canada to be economically self-sufficient—that is, not reliant on other countries for either raw materials or finished consumer goods. He believed that Canada's central provinces, Ontario and Quebec, were capable of developing robust manufacturing industries that could supply goods to the entire Canadian consumer market, from the east coast to the west coast. The

eastern and western provinces, conversely, could supply Ontario and Quebec with the raw materials needed to sustain and expand manufacturing activities (Eden & Molot, 1993, p235). To create a cohesive, integrated, and independent national economic system, Macdonald and his government carried out two major initiatives. First, they sponsored the construction of railroads that could transport people and goods between the various provinces. Second, they levied tariffs on imported consumer goods from the United States, Great Britain, and other countries. For example, the government levied a 30 percent tariff on earthenware pottery, a 15 percent tariff on candles and paraffin wax, and a 35 percent tariff on clocks and clock parts (Williams, 1979, p341-342). These tariffs effectively protected young manufacturing enterprises in Ontario and Quebec from foreign competition, allowing them to sell their goods at reasonably high prices. As many economic historians have pointed out, however, the tariffs had an ulterior purpose—namely, to encourage foreign enterprises (especially American enterprises) to “jump over the tariff wall” by establishing branch plants in Canada (Naylor, 2006, p40-60). By the start of the first world war, many American enterprises had established branch plants in Canada (mostly in Ontario and Quebec) in order to circumvent the tariffs. Some of these enterprises included Wagner Electric, American Cynamid, United Drugs, Ford Motor Company, and Goodyear Tire and Rubber (Williams, 1979, p352-353).

During the first world war, the federal government established the Honorary Advisory Council on Scientific and Industrial Research, a committee made up of respected Canadian scientists and engineers. Led by Archibald Macallum, a prominent Canadian biochemist, the Advisory Council sought to “organize, mobilize, and encourage existing research agencies in Canada, so as to utilize waste products, discover new processes, and exploit unused natural resources” (Eggleston, 1978, p4). The first task faced by the Advisory Council was to assess the

current state of scientific and industrial research in Canada. To do this, the Council sent universities and industrial enterprises questionnaires asking them about their research facilities, research personnel, and research activities. Through this investigation, the Council discovered that research is woefully underfunded and under-supported in Canada:

“Four sets of questionnaires were prepared, and thousands of copies were sent out. There were over ten thousand industrial firms listed in the Dominion Bureau of Statistics, and all were canvassed. Replies were received from about twenty-four hundred. Only thirty-seven of them reported operating research laboratories at all, and the total staff in those, of all ranks, aggregated only one hundred and sixty-one people. Aside from salaries, the total national amount spent on industrial research in a year came to only \$135,000. The situation reported by universities was not much more cheerful. Only two universities were engaged in extensive research, and in the past thirty-three years only eleven doctoral degrees in science had been awarded. Dr. Macallum later estimated that in the whole of Canada, there were not more than fifty persons that engaged in what might be termed *pure* research” (Eggleston, 1978, p7).

Soon after conducting this survey, the Advisory Council quickly took action to improve Canada’s research capacities. It provided scholarships to graduate students in scientific fields of study, although the war had greatly depleted the graduate student population. It also provided grants to scientists to undertake ambitious research projects. For example, in 1917, the Council gave a grant to Walter Thompson, a professor of biology at the University of Saskatchewan, to develop a disease-resistant strain of wheat (Estey, 1992, p119-120).

In the early 1920s, the Honorary Advisory Council on Scientific and Industrial Research was transformed into the National Research Council of Canada (NRC). Like its predecessor organization, the NRC conducts scientific surveys, provides scholarships and research grants, and coordinates research activities across Canada. In addition, the organization operates its own research laboratories, where scientists engage in both basic and applied research. Throughout the 1920s and 1930s, the NRC funded many research projects related to agriculture (Estey, 1992, p124-129). Many of these projects directly responded to the needs of farmers in Alberta and

Saskatchewan, who faced many challenges with plant cultivation and animal breeding. One project sought to determine the dietary value of barley, oats, wheat, rye, and corn for livestock. Other projects sought to develop new methods for drying wet wheat, controlling weeds, eliminating plant-killing pests, and preventing the spread of diseases among farm animals. During the second world war, the NRC became a major sponsor of medical research. Through its Committee on Medical Research, the organization funded scientific investigations into tuberculosis, influenza, muscular dystrophy, anaemia, metal poisoning, and decompression sickness, among other ailments (Romano, 1992, p85-87). Medical research remained a primary focus of the NRC throughout the 1940s and 1950s (Li, 1992).

Prior to the second world war, the federal government followed a very simple model of governance. Under this model, the Prime Minister met regularly with cabinet ministers to discuss pressing domestic and international issues, develop public policies, and establish a general direction for the government and for the nation. Cabinet meetings were often highly informal and unstructured, as the Prime Minister set priorities and introduced discussion topics on a whim, and ministers put forward policy proposals without providing any advanced notice to their colleagues. Cabinet discussions and decisions were not recorded or documented, because there was no cabinet secretariat (Schacter, 1999, p4). The cabinet often made decisions without seeking the advice of civil servants. Once Canada declared war on Germany in 1939, the federal government adopted a much more elaborate and rigorous governance system. Under the leadership of William Mackenzie King, the federal cabinet became more professional and disciplined in its conduct. For the first time, cabinet ministers were divided into different sub-committees, with each sub-committee dedicated to a particular policy area. A cabinet secretariat was hired to keep records of all cabinet activities and to enforce high standards of collegiality

among ministers (Savoie, 1999, p112-113; Schacter, 1999, p4-5). During this inter-war period, the federal government had to mobilize all of Canada's human, natural, and industrial/technological resources to fight the axis powers, while maintaining basic social, economic, and civic institutions. Overwhelmed by this herculean task, the Prime Minister and his cabinet ministers increasingly turned to civil servants for guidance and support. In some cases, ministers delegated decision-making to their ministerial staffs (Matheson, 1976, p226-227). As these civil servants assumed greater decision-making authority, power shifted slightly away from the cabinet and towards the bureaucracy.

Throughout the second world war, the federal government intervened heavily in the Canadian economy. At the start of the war, it established a new agency called the Wartime Prices and Trade Board, which controlled the prices of various consumer goods in order to prevent inflation (Waddell, 1981). The agency also punished individuals for hoarding essential goods or for "impeding the production and distribution" of such goods. C.D. Howe, the federal Minister of Munitions and Supply, oversaw the creation of almost thirty federal crown corporations, including Victory Aircraft, Polymer Corporation, Research Enterprises, and Turbo Research (Savoie, 2006, p30-31; McQuaig, 2019, p8-9). With direct funding from the federal government, these corporations designed and manufactured equipment for the Canadian army, such as aeroplanes, radar units, binoculars, and radios. After the war, Howe dismantled many of these corporations, arguing that they were unnecessary during a time of peace, and that their continued existence would undermine the workings of the free market system. Under Howe's direction, the federal government ended many of the activist, *dirigiste* industrial policies that it enacted during the war. At the same time, it introduced new social programs for citizens, such as family allowances, disability benefits, universal old age pensions, and an enlarged unemployment

insurance (Rice & Prince, 2013, p71-82). By expanding the welfare state, the government not only hoped to enhance the comfort and security of Canadian citizens, but also to stimulate consumer demand and regulate the business cycle (Eden & Molot, 1993, p237). Federal policymakers viewed these social policy initiatives as a means of achieving macroeconomic stability. In 1957, the federal government began providing 'equalization payments' to certain provinces, specifically those with small economies and tax bases or those experiencing economic hardship (Lecours & Beland, 2010, p571). These payments, which continue to be given to some provinces today, are mostly intended to cover the costs of social programs.

In the 1960s, the federal government carried out three major economic/industrial policy initiatives. The first initiative was the creation of the Medical Research Council (MRC) in 1960. With an initial budget of \$2.3 million, the MRC provided scholarships to young medical students and research grants to experienced medical researchers (Medical Research Council, 2000, p9). The organization operated under the aegis of the National Research Council until 1969, when it became an independent crown corporation accountable to the Minister of National Health and Welfare. Over the next few decades, the MRC became a major promotor of industrial-academic collaboration. The second initiative was the negotiation of an automotive trade agreement with the United States in 1965. Under this agreement, which was commonly referred to as the 'Auto Pact', American automobile companies were able to export new vehicles to Canada without being subject to tariffs. In return, these companies had to produce a certain amount of vehicles in Canada (Anastakis, 2005, p85-125). In the years following the enactment of the Auto Pact, American auto companies like Ford and Chrysler built and expanded many production facilities in Canada, especially in southern Ontario. The third initiative was the creation of the Department of Regional Economic Expansion (DREE) in 1969. DREE was a federal department run for

many years by Tom Kent, a respected journalist and Liberal Party operative who served under both Lester Pearson and Pierre Trudeau. The purpose of DREE was to promote economic growth and development in poor or less developed regions of Canada, especially those in the Maritime provinces. To accomplish this noble but difficult goal, the new department funded vital physical infrastructure (highways, water and sewage systems, schools) and provided business subsidies (Bryden, 2007; Savoie, 2007, p91).

When Pierre Trudeau became Prime Minister in 1969, he hoped to shift the balance of power within the federal government away from the bureaucracy—that is, the corps of professional, unelected civil servants—and towards the executive branch. Since 1940, federal bureaucrats or civil servants had assumed more and more decision-making authority, thus taking power away from the Prime Minister, cabinet ministers, and other executive actors. In order to reassert executive control over the decision-making and policymaking process, Trudeau strengthened a number of executive bodies, including the Prime Minister’s Office, Privy Council Office, and cabinet (Matheson, 1976, p170; Savoie, 1999, p84-85). He gave cabinet ministers more powers and responsibilities, partly by expanding the role of cabinet committees. Two new committees, the Economic Development Committee and the Social Development Committee, were created to make budgeting and resource-allocation decisions for multiple departments (Schacter, 1999, p6). During committee sessions, ministers were expected to share information with each other, engage in vigorous debates over social and economic issues, and collectively develop new policy ideas and proposals. It was important to Trudeau that the executive branch not only hold the primary levers of power, but also use these levers in a rational, methodical, and judicious manner.

Having consolidated power within the executive branch, Trudeau proceeded to carry out a number of ambitious, far-reaching, and transformative industrial policies. Some of these policies sought to protect Canada's economic sovereignty in the face of foreign (especially American) encroachment. In 1974, the Trudeau government established a new agency called the Foreign Investment Review Agency (FIRA), which controlled and regulated the flow of foreign direct investment into Canada (Globerman & Shapiro, 1999, p515-516). Between 1974 and 1985, foreign corporations could only establish branches or subsidiaries in Canada, or take over existing Canadian corporations, if they received the blessing and approval of FIRA. FIRA imposed very tight restrictions on foreign investment in 1980, when it came under the leadership of Herb Gray, an ardent economic nationalist. The same year, the federal government introduced the National Energy Program (NEP), one of the most controversial and polarizing industrial policies in Canada's history. The NEP targeted the Canadian oil industry, which had become highly profitable in the 1970s due to rising oil prices. As Jenkins (1986) explains, the NEP had three goals:

“The NEP's stated objectives were threefold: (1) to provide for energy security, meaning greater Canadian self-sufficiency in oil and less dependence on the world market; (2) to establish fairness in pricing and revenue sharing, which translated into a much lower consumer price for domestic crude than foreign oil and a larger haul of energy revenues for the federal government; and (3) to increase opportunities for Canadian participation in the oil industry, meaning more Canadian ownership of an industry that at the time was more than 70 percent foreign-owned” (Jenkins, 1986, p146).

In order to accomplish these goals, the NEP imposed new federal taxes on both domestic and foreign oil companies while maintaining an existing system of oil price controls. It also provided grants to Canadian-owned oil companies to support their oil exploration and drilling activities, especially in the 'Canada Lands' — that is, parts of the Arctic and Atlantic Ocean that lie outside of provincial boundaries. Lastly, the NEP allowed the federal government to obtain a major

ownership stake in all current and future oil sites in the Canada Lands. While these initiatives were supported by Ontario, Quebec, and the Maritime provinces, they were bitterly opposed and resisted by Alberta. Political and business leaders in Alberta blamed the NEP for the stagnation of Alberta's oil industry in the early 1980s.

In 1984, the federal Conservative Party was elected to power in a landslide victory, with Conservative leader Brian Mulroney becoming Canada's new Prime Minister. Mulroney had a much different approach to economic and industrial policy than Pierre Trudeau. Whereas Trudeau sought to control and direct private sector investment and activity through various government programs, Mulroney sought to free the private sector from government interference. Also, while Trudeau sought to make Canada more economically independent from the United States, Mulroney sought to increase Canadian-American economic integration. One of the first actions taken by Mulroney was the termination of the National Energy Program and the deregulation of oil prices, a move that was highly welcomed by Alberta's political and business leaders (Eden & Molot, 1993, p242). Around the same time, Mulroney dismantled the Foreign Investment Review Agency, thus opening Canada to more foreign direct investment. He also privatized a number of federal crown corporations, including Polysar, Air Canada, Teleglobe, and Petrocan (Eden & Molot, 1993, p243). During Mulroney's second term in office, Canada entered into a free trade agreement (FTA) with the United States, allowing goods to flow between the two countries unimpeded by tariffs or other trade barriers. Under the FTA, Canada was not only prohibited from levying tariffs on American goods, but also from giving preferential treatment to Canadian-owned enterprises (Hart, 2007, p68). The introduction of the FTA signalled the death of economic nationalism in Canada and the rise of economic continentalism and globalization.

Brian Mulroney not only differed from Pierre Trudeau in his approach to industrial policy, but also in his approach to governance. His cabinet contained approximately forty cabinet ministers and fourteen cabinet committees, making it quite large by historical standards. The most powerful committee in his cabinet was the Priorities and Planning Committee, which consisted of twelve members, including Brian Mulroney himself, the minister of finance, the president of the Treasury Board, and a handful of senior cabinet ministers. The Priorities and Planning Committee was responsible for establishing the government's overall strategy and fiscal framework, setting the agenda for cabinet meetings, and monitoring and policing other cabinet committees (Crosbie, 2007, p394-395). Although this committee existed under Trudeau, it now played a much larger role in the executive decision-making process. As Schacter (1999) explains, Mulroney transformed this committee into an all-powerful 'inner cabinet' while reducing the power and influence of all other committees. Power thus became more centralized, as Mulroney and the Priorities and Planning Committee maintained almost total control over the executive branch of the government. When Jean Chretien became Prime Minister in 1993, he eliminated the Priorities and Planning Committee, thus decentralizing power within the executive branch. He also reduced the number of cabinet ministers from forty to twenty-three and the number of cabinet committees from fourteen to four (Schacter, 1999, p8-9). As we will see later, provincial-level cabinets also became smaller and leaner during this time.

In the early 1990s, the federal government became highly concerned about issues of environmental sustainability, pollution, and global warming. Federal policymakers recognized that rising levels of carbon dioxide, methane, and other greenhouse gasses in the atmosphere was leading to rising global temperatures, with devastating consequences for humans, plants, and animals. They also recognized that the extraction, distribution, and consumption of oil generated

massive amounts of greenhouse gasses. Under the leadership of Jean Chretien, the federal government carried out various initiatives to combat global warming, the first of which was the Climate Change Voluntary Challenge and Registry Program (VCR). Launched in 1995, this program “[invited] individual companies from major emitting sectors to submit action plans of measures they intend to use to reduce greenhouse gas emissions” (Samson, 2001, p203). Soon after this, Canada signed onto the Kyoto Protocol, an international treaty on greenhouse gas reduction. As a signatory to the treaty, Canada was “committed to reducing greenhouse gas emissions to six percent below 1990 levels by 2008” (Brownsey, 2007, p152). To ensure that Canada met its Kyoto commitments, the federal government “encouraged individual Canadians to reduce their greenhouse gas emissions” and “supported research into alternative energy sources such as wind, solar, biofuels, and even newer nuclear power technologies” (Brownsey, 2007, p144). In 2001, the government created an arms-length foundation called Sustainable Development Technology Canada (SDTC), which provides early-stage or seed capital to small ‘green enterprises’ throughout Canada (Montambault, 2009). These enterprises develop and commercialize new products and technologies that allow people to consume less energy and reduce their carbon footprints. Unfortunately, all of these federal initiatives failed to lower Canada’s greenhouse gas emissions. In fact, between 1990 and 2003, Canada’s emissions *increased by 25 percent*, mostly because the country’s oil and gas industry expanded significantly during this period (Karimi, 2005, p501; Bruneau & Renzetti, 2009, p3).

Between 1994 and 2000, the federal government helped lay the groundwork for the coming internet revolution. At the time, the internet was a new, paradigm-shifting technology that promised to fundamentally change how individuals, businesses, and government agencies communicate and transmit information. Although the internet had already been adopted by some

public and private organizations in Canada, it was still mystifying to the majority of the Canadian population. In order to acclimate Canadians to this technology, the federal government provided computers to schools and libraries throughout the country, and then connected these computers to the internet through a program called SchoolNet (Doern, Castle & Phillips, 2016, p330). Some private technology companies contributed to this program by donating their own computers. In a speech delivered to the Information Technology Association of Canada in 1998, Prime Minister Chretien highlighted the tremendous success of the SchoolNet program:

“SchoolNet is one of our proudest achievements. It is a public and private sector partnership launched in 1994 to connect all of the public schools and libraries in Canada to the Internet and each other. It is now being copied around the world...In 1994, there were no public schools or libraries online. In 1995, 3,000 schools and libraries were connected. By 1996 we reached 7,000. In 1997, we crossed the 13,000 mark. By the end of this year, all 20,000 schools and libraries will be surfing the Net. And we will reach this goal a full two years ahead of the Americans and four years ahead of the British” (Chretien, 1998).

In the year 2000, it became possible to access the internet through a high-speed cable instead of through a telephone line. This new method of access, called ‘broadband’, allowed internet users to send and receive information at much higher speeds than before. In response to this development, the federal government established the National Broadband Taskforce, which developed a strategy to extend broadband to all Canadian communities, including rural and Indigenous communities (Industry Canada, 2001; Doern, Castle & Phillips, 2016, p335).

Governance and Industrial Policy in Ontario

Throughout its early history, Ontario was dominated politically by Oliver Mowat, who served as premier of the province between the years 1872 and 1896. A former lawyer, Mowat governed Ontario with extreme efficiency and deftness. He created an elaborate system of political patronage that guaranteed mass loyalty to his political party (the Liberal Party) (Noel, 1997, p61-62). During his twenty-four year tenure as premier, Mowat focussed on the economic

development of northern Ontario, which was rich in natural resources but contained very little economic activity. At first, he tried to encourage farmers to set up agricultural settlements in northern Ontario by building railroads and ‘colonization roads’ linking the northern and southern regions of the province. He also constructed and maintained ‘experimental pioneer farms’ in northern Ontario, which he hoped would demonstrate the viability of farming in this remote and desolate region. By the 1890s, however, Mowat and other government officials realized that northern Ontario is better suited for heavy industry than for agriculture and homestead farming:

“The north needed capital more than farmers; it was more of an industrial than an agricultural frontier. That was the message percolating out from government publications and the financial press during the 1890s to form part of the popular conception of the north. The endless spruce forests would support scores of pulp and paper mills; rivers could be harnessed with great dams and generating stations; the Shield could be made to yield up the vast hordes of precious minerals it was known to be hiding” (Nelles, 2005, p55-56).

In 1891, Mowat created a government ministry called the Bureau of Mines, which was dedicated to growing the nascent mining and smelting industry in northern Ontario. Soon after its creation, the Bureau of Mines began conducting geological surveys in the north; it collected information on northern mineral formations, and then disseminated this information among miners and prospectors. A few years later, the ministry established the Iron Mining Fund, which provided subsidies to iron ore smelters (Nelles, 2005, p130). It also created a series of ‘mining schools’ where prospectors, metallurgists, and mining engineers could receive specialized training. All of these measures signalled a shift in economic policy away from agriculture and toward heavy industry.

After Oliver Mowat resigned from the premiership in 1896 to pursue a career in federal politics, his successors Arthur Hardy and George Ross continued to promote industrialization in northern Ontario. Both Liberal premiers introduced laws designed to cultivate a strong lumber and pulp industry in the north. These laws required that all timber extracted from northern crown

lands be processed into lumber or chemical pulp, rather than merely exported in their raw form to the United States (Nelles, 2005, p86-87). With the rise to power of the Conservative Party in 1905, the provincial government expanded its subsidies for metal refining operations. Even more importantly, it established the Ontario Hydro-Electric Power Commission, a public utility company that sought to provide all residents of Ontario with access to cheap electric power. Led by Adam Beck, a Conservative cabinet minister and ardent supporter of ‘public power’, the Commission built and operated its own electric transmission lines. Spanning hundreds of miles long, these lines brought power from private generation stations in Niagara to various municipalities across Ontario. During World War I, the Commission began producing its own electricity, much to the chagrin of private electric generating companies:

“During the war, Hydro ceased being a mere distributing company carrying power as inexpensively as possible from the producers at Niagara to the municipal consumers. Under Adam Beck’s dictatorial direction it rapidly developed into a fully integrated generation, transmission, and distribution organization striving towards monopoly throughout its domain” (Nelles, 2005, p364).

By the time of the second world war, the Ontario Hydro-Electric Power Commission had become the dominant producer and supplier of electricity in the province. By providing electricity to manufacturers and other consumers ‘at cost’—that is, at a low price that reflects the true cost of power generation and transmission—the Commission helped create the conditions for rapid industrialization (McQuaig, 2019, p110-111).

As heavy industries expanded in Ontario throughout the early twentieth century, there was growing recognition among workers, educators, business leaders, and politicians of the importance of technical education. It was increasingly understood that Ontario’s industrial economy required a skilled workforce, one that was familiar with the basic principles of science and mechanical engineering and was able to adapt to changes in industrial techniques. Under

pressure from powerful business organizations, the provincial government introduced the *Industrial Education Act* in 1911. This policy created industrial training opportunities for both young people entering the workforce for the first time and experienced workers seeking to retrain or enter new industries:

“General industrial schools were established in order to offer training in the basic trades as well as in subjects considered essential for a good general education. Special schools were created for the purpose of providing theoretical and practical instruction in specific trades practised in local communities. Within high schools, technical departments were developed throughout the province. And for those already working in industry, co-operative industrial schools and evening courses were designed to provide practical and theoretical instruction in specific occupations” (Axelrod, 1982, p10-11).

The passage of the *Industrial Education Act* coincided with the transformation of Ontario’s university system. Virtually all universities across the province became more attuned to industrial needs and interests, as they introduced more academic programs with practical or technical focuses. Within each university, new departments arose specializing in mining, forestry, chemistry, engineering, physics, and architecture. Some universities, such as the University of Western Ontario and Queen’s University, ceased to be religious or ecclesiastical institutions and expanded their technical course offerings (Axelrod, 1982, p12). By the 1920s, post-secondary education in Ontario was largely secular and non-denominational, concerned more with corporeal matters (industry) than spiritual matters.

Between 1904 and 1921, Ontario became a host to American automobile manufacturers, specifically General Motors, Ford Motor Company, and Chrysler (Anastakis, 2005, p18-19). In order to achieve greater economies of scale, these manufacturers established branch plants in Oshawa and Windsor, two cities in southern Ontario. Each branch plant produced motor vehicles for the general market, sometimes using parts and components provided by Canadian suppliers. After the second world war, the automobile industry in Ontario grew considerably, as additional

branch plants were built and production was increased to meet rising consumer demand (Anastakis, 2005, p23). Most new branch plants were concentrated geographically within the Toronto-London corridor, where they were situated close to major markets, suppliers, and corporate headquarters (Kerr & Spelt, 1960, p12). By the year 1960, approximately one-third of all manufacturing activity in Canada was located within the Toronto-London corridor, with much of this activity accounted for by automobile manufacturing. Interestingly, the provincial government of Ontario did not play a major role in the emergence and expansion of automobile manufacturing during this period. In fact, between 1910 and 1960, industrial policy receded in importance in Ontario. The only notable industrial policy enacted by the provincial government was the creation of the Ontario Research Foundation in 1928. Like its counterparts in other provinces, the Ontario Research Foundation was a government-funded research body that possessed its own laboratory, scientific equipment, and scientific staff. For many decades, it worked with industrial actors to develop new production methods and processes, and to discover new commercial uses for Ontario's natural resources (Bird, 1985, p56; McNicholl, 2006).

The 1960s was a decade of tremendous growth for Ontario's post-secondary education system. John Robarts, who served as premier throughout the decade, oversaw the creation of new colleges and universities and the expansion of existing ones. During his tenure, the number of students enrolled in the province's universities more than doubled and the amount of government funding for universities more than quadrupled (Axelrod, 1982s, p141). A new government body called the Department of University Affairs was created to manage and coordinate post-secondary education (Axelrod, 1982, p95). In 1966, Robarts created the Ontario Development Corporation (ODC), a crown corporation focussed on small business development. The ODC provided both financial and non-financial assistance to small businesses in Ontario, especially

small manufacturing enterprises (Bird, 1985, p56). It gave businesses loans on extremely generous terms, guaranteed their loans with private lenders, and advised them on technical, financial, and logistical matters. Robarts not only made changes and additions to education and industrial policy, but also to the institutions of government. One of his objectives as premier was to update the province's public service or bureaucracy, which was quite antiquated in its structures and practices. To do so, he raised the salaries of civil servants, introduced new training programs, and incorporated "modern administrative techniques" into government ministries (Morton, 1997, p16). Through these reforms, the bureaucracy became an efficient and disciplined machine for the implementation of public policy. Near the end of his ten-year term in office, Robarts began the process of modernizing Ontario's executive branch of government, including the cabinet. He appointed the Committee on Government Productivity, which proposed a number of changes to the cabinet and its related offices (Loreto 1997, p95). Most of these proposed changes were introduced in the 1970s under Robarts' successor Bill Davis.

As we saw previously, Ontario's automobile industry thrived in the 1940s and 1950s, as American automobile companies established new branch plants in southern Ontario and increased levels of production. By the early 1960s, however, the industry encountered major technical challenges. Branch plants could not produce many of the newer vehicles desired by Canadian consumers, because they lacked certain tools, components, and facilities (Anastakis, 2005, p25). As a result, dealerships in Ontario (and other provinces) had to import vehicles from the United States, which worsened Canada's trade deficit. In an effort to bolster Ontario's struggling automobile industry and reduce the trade deficit, the federal government negotiated a new trade and investment deal with the United States in 1965: the Canada-U.S. Automotive Products Trade Agreement (Auto Pact). Under this deal, American automobile companies were

exempted from paying import and export tariffs as long as they agreed to make substantial investments in Canada. In the years following the introduction of the Auto Pact, new branch plants were created and old ones were expanded in a number of Ontario towns and cities, including Oshawa, Oakville, Windsor, St. Thomas, and Brampton (Anastakis, 2005, p125). The Auto Pact was widely seen as a double-edged sword. On the one hand, it succeeded in boosting automobile production in Canada (especially in Ontario) and in attracting additional American direct investment to Canada. On the other hand, it reinforced American domination over the Canadian automobile industry. There was a growing belief at the time, expressed by Canadian economic nationalists, that American corporations controlled too much of the Canadian automobile sector (and indeed the entire manufacturing sector). In her 1970 book *Silent Surrender*, Kari Levitt pointed out that half of all manufacturing operations in Canada were owned and controlled by American corporations, such as General Motors and Ford Motor Company (Levitt, 2002 [1970], p61-62). She also argued that the spread of American branch plants in Ontario (and elsewhere) funnelled wealth out of Canada, marginalized and disempowered Canada's entrepreneurs, and undermined Canada's technological and innovative capacities. This view was shared by some elected officials in federal and provincial governments (Gordon, 1966).

In the early 1970s, the executive branch of the Ontario government was expanded to include new administrative and policymaking bodies, such as the Policy and Priorities Board, Management Board Secretariat, and Treasury Board. These bodies prepared estimates of government revenue and expenditure, established fiscal plans for each ministry, and set the agenda for cabinet discussions (Glenn, 2005, p157-158). At the same time, members of cabinet were instructed to form 'policy committees' dedicated to studying social and economic problems,

and devising policy solutions to these problems (Evans, 2016, p108). All of these institutional changes, which followed the recommendations of the 1969 Committee on Government Productivity, allowed the executive branch to respond more effectively to the exigencies of modern Canadian society. Now possessing an enlarged and enhanced executive branch, the provincial government proceeded to introduce a slew of new industrial policies. One of these policies involved the creation of hundreds of Small Business Development Corporations (SBDCs) throughout Ontario. With funding from private investors, including both individuals and corporations, the SBDCs financed small Ontario businesses with less than 150 employees (Bird, 1985, p59-60). Another policy involved the identification of skill gaps in the Ontario labour force, and the creation of high-tech training programs for workers and the unemployed. It should also be noted that, throughout the 1970s, the provincial government subsidized industrial R&D through programs such as the Technology Assessment and Planning Program and the Program to Encourage Product and Process Innovation. The government also encouraged American automobile companies to establish additional branch plants in Ontario by providing them with financial incentives. For example, in 1978, the provincial government (in partnership with the federal government) offered to give Ford Motor Company a \$68 million grant if the company agreed to open a new engine plant in Windsor (Anastakis, 2018, p117-118). This practice continued into the 1980s and beyond.

Ontario experienced tremendous economic turmoil in the 1980s due to globalization—that is, the acceleration of international trade and investment and the creation of a highly interconnected global economy (Bradford, 2003, p1008). One manifestation of globalization in Ontario was the influx of Japanese automobiles, which threatened the market position of General Motors, Ford, and Chrysler. Even more important was the creation of branch plants by Japanese

automobile companies. In 1984, Honda built a branch plant in Alliston, a small town about 100 kilometres north of Toronto (Anastakis, 2013, p285-286). Honda was soon followed by Toyota, Nissan, and Suzuki, making Ontario a major destination for Japanese foreign direct investment. Japanese branch plants were willing to purchase components from Ontario suppliers, but only if they could meet certain technical standards. As the Japanese presence in Ontario grew, the Canadian federal government began to negotiate a free trade agreement with the United States (Anastakis, 2013, p309-330). Many people in Ontario worried that, if unconditional free trade was established between Canada and the United States (as the federal government desired), then Ontario's automobile industry would be destabilized. One common fear was that American automobile companies would shift production out of Ontario, thus creating mass unemployment in Windsor, Oshawa, and other 'auto cities' (Clarkson, 1999, p85). Taking a broader perspective, some suggested that Ontario's manufacturing sector at large would face growing competition from the United States, resulting in factory closures across southern Ontario.

As Japanese automobiles and branch plants proliferated in Ontario, and as free trade loomed on the horizon, the provincial government of Ontario was compelled to develop a new industrial strategy, one which would allow the province to thrive in an era of globalization (Bradford, 2003, p1008). This strategy had two planks. First, it sought to increase the innovative capacity of Ontario's traditional manufacturing industries, such as auto parts, electronics, food, chemicals, and chemical products. David Peterson, who was premier at the time, believed that the manufacturing sector could only withstand global competition if it adopted new productive technologies and focussed on product innovation or "value-added production" (Bradford, 1998, p545). Second, it sought to foster new knowledge-based industries, such as photonics, telecommunications, medical technology, and clean energy. To achieve these objectives, the

government introduced the Ontario Centres of Excellence program and the Technology Fund, both of which encouraged collaboration between businesses in different sectors and academic/research institutions (Bell, 1996). It also introduced the R&D Super Allowance, which allowed businesses to deduct R&D expenses from their corporate income taxes. In 1990, Peterson was succeeded by Bob Rae, the first New Democrat to be elected premier. Like his predecessor, Rae strongly supported knowledge-based industries, technological innovation, and value-added production. Through his Sector Partnership Fund, Rae promoted inter-firm cooperation within both established and emerging industries (Drache, 1999, p68; Wolfe & Gertler, 2001, p585). In some industries, such as automobile parts and food processing, inter-firm cooperation led to the adoption of new technologies, production methods, marketing strategies, and worker training programs.

Both David Peterson and Bob Rae believed that Ontario must embrace a new economic paradigm based on collaboration, networking, and partnerships. In their view, Ontario can only prosper economically if firms, universities, research institutions, and government actors work together to diagnose and solve industrial problems (Bradford, 2003, p1008-1010). This ethos of cooperation extended from the economic realm to the governance realm. Throughout the Peterson-Rae period, the provincial government made a serious effort to consult with labour unions, women's advocacy groups, environmental justice groups, and other civil society organizations while designing public policy (Loreto, 1997, p95-96). In some cases, the government allowed representatives of these organizations to join public policymaking bodies, like the Premier's Council on Science and Technology and the Ontario Training and Adjustment Board (OTAB) (Bradford, 1998, p552-553). By allowing non-state actors to participate in the policymaking and decision-making process, the provincial government adopted a new model of

governance, one that Neil Bradford calls ‘associative governance’. When Mike Harris became premier in 1995, the provincial government abandoned associative governance and returned to a classic, centralized model of governance. Harris and his Progressive Conservative Party completely severed the ties that had been established between the provincial government and civil society organizations or ‘interest groups’:

“A unifying theme across the fiscal and institutional-municipal components of the Conservative agenda was the reduction in interest group political influence as it had developed through the NDP’s social partnerships. Legislative amendments were made in labour relations, employment equity, and social assistance to limit the resources and policy voice of unions, social equity movements, and anti-poverty activists. In turn, the Premier’s Council, the SPF, and OTAB, structures that had institutionalized a policy role for civil society representatives, all disappeared in the government’s first year” (Bradford, 2003, p1018).

In addition to banishing civil society organizations from the policymaking domain, Harris also greatly simplified the structure of cabinet. Immediately after gaining power, he reduced the number of cabinet ministers, eliminated the various policy committees, and scrapped the Treasury Board (Loreto, 1997, p101; Glenn, 2005, p160-161). By creating a stripped-down, austere cabinet, Harris hoped to accelerate the decision-making process. He believed that maintaining a robust cabinet and complex governance system consumed too much time and public resources.

Harris was elected on a neoliberal platform dedicated to cutting taxes, shrinking the size of the provincial government, and liberating the private sector from bothersome government regulations and intrusions. In his view, government intervention in the economy should be avoided, because it distorts market signals and renders firms dependent on the state. It is not surprising, then, that he was initially reluctant to provide direct financial assistance to industry or to corral the Ontario business community around industrial development projects. During his first two years in office, Harris did not launch any industrial policies. Instead, he scaled back the

industrial policies carried out by his predecessors—he partly dismantled the Ontario Development Corporation, completely eliminated the Sector Partnership Fund, and discontinued nearly \$230 million in industrial grants and loans (Clarkson, 1999, p98). In 1997, however, Harris introduced the R&D Challenge Fund, signalling a slight shift in direction. With a budget of \$500 million, the R&D Challenge Fund provided funding for R&D projects carried out jointly by firms, universities, and research institutions (Fattori, 1999; Wolfe & Gertler, 2001, p587). Unlike the Ontario Centres of Excellence program, which focused on basic or fundamental R&D, this new program focused on applied R&D. Shortly after his re-election in 1999, Harris established the Superbuild Corporation, a crown corporation that promoted and facilitated the privatization of public infrastructure, such as highways and water treatment facilities (Bradford, 2003, p1020). Around the same time, he radically transformed Ontario’s energy system, which was monopolized by Ontario Hydro (formerly the Ontario Hydro-Electric Power Commission). Through the Energy Competition Act, Harris split Ontario Hydro into various smaller organizations, including Hydro One and Ontario Power Generation. He then allowed private energy companies to sell power to consumers and tried (unsuccessfully) to deregulate energy prices (Winfield & MacWhirter, 2018, p367-368). These reforms were intended to bring market competition into the energy system, thus placing downward pressure on energy costs and prices for consumers.

Between the years 2003 and 2018, Ontario was governed by the Liberal Party under premiers Dalton McGuinty and Kathleen Wynne. Both McGuinty and Wynne were more willing to intervene in the economy than Mike Harris. During his second year in office, McGuinty launched the Ontario Automotive Investment Strategy, an initiative that sought to attract new foreign automotive investment to Ontario (Anastakis, 2018, p119-120). As part of this initiative,

McGuinty created various financial incentives for foreign automobile companies to set up branch plants in Ontario, much as Bill Davis did in the 1970s and David Peterson did in the 1980s.

Around the same time, he announced that his government would pursue an ambitious ‘innovation agenda’ that would support Ontario’s transition to a ‘knowledge economy’ and cultivate an ‘innovation culture’ within the province (Sharaput, 2012, p255-257). This agenda was planned and implemented by a new ministry called the Ministry of Research and Innovation (MRI).

Through the Ontario Research Fund, the Strategic Jobs and Investment Fund, and other programs, MRI fostered innovation networks and upgraded Ontario’s technology infrastructure (Ministry of Research and Innovation, 2014). The ministry also oversaw the creation of seventeen Regional Innovation Centres, nonprofit organizations that assist small innovative companies with financing, business planning, and networking. In 2017, Kathleen Wynne sold the majority of the provincial government’s shares in Hydro One, thus continuing the mission of Mike Harris to marketize the energy system (Winfield & MacWhirter, 2018, p382-383).

McGuinty and Wynne were quite different from Harris with regard to governance. While in power, they increased the number of cabinet ministers, allowed deputy ministers to provide direct policy advice to cabinet ministers, and restored the policy committees that investigate important public policy issues (Evans, 2016, p109-112). Neither of them returned to the ‘associative governance model’ of Peterson and Rae, however.

Governance and Industrial Policy in Alberta

Alberta became a province in 1905, almost forty years after Confederation. The first premier of the province was Alexander Cameron Rutherford, a Liberal who previously served in the legislative assembly of the Northwest Territories. As the political leader of a young and relatively underdeveloped province, Rutherford oversaw the creation of a rudimentary civil

service and legal system, as well as the construction of basic government buildings (Thomas, 1979, p7). To unify Alberta's sparse population of farmers, Rutherford funded new railway lines and a public telephone system. In 1910, it was discovered that Rutherford had grossly mismanaged the funding of a new railway line in northern Alberta, pledging far more public money for the construction of the line than was necessary. This event not only led to Rutherford's resignation, but also significantly undermined public trust and confidence in the Liberal Party and other major political parties (Thomas, 1979, p9). Outraged by the corruption and incompetence they had witnessed under Rutherford, Alberta residents increasingly yearned for alternative political parties, ones that would hopefully be more honest, transparent, and democratic. The Liberal Party saw its public support diminish throughout the 1910s, culminating in its defeat at the hands of the United Farmers of Alberta (UFA) in 1921. The UFA was not just a political party, but was also an association of farmers that advocated for agrarian economic interests. Upon gaining power, the UFA adopted an unconventional and even radical model of governance, one based on participatory democracy and direct democracy (Pal, 1992, p12; Brownsey, 2005, p214). Under this model, the premier and cabinet did not make decisions unilaterally, as was typical across Canada. Instead, they worked closely with UFA delegates on the formulation of public policy. These delegates were elected by regular UFA members, most of whom were wheat, livestock, and dairy farmers. Every year, the UFA party and association held general meetings or conventions, during which delegates could discuss public policy issues, vote on policies, and interact with UFA caucus members and cabinet members.

The stated goal of the UFA was to promote the welfare, economic security, and prosperity of Alberta's farmers. As such, all of its economic policies and industrial policies centred around the agricultural sector. One of the most important policies enacted by the UFA was the creation

of the Alberta Wheat Pool in 1923 (Betke, 1979, p22-23). This nonprofit organization served as an intermediary between Alberta's wheat farmers and foreign buyers of wheat. It purchased wheat from farmers at a standardized price, sold the wheat to buyers in Europe and the United States, and then distributed the profits (if there were any) among the farmers. The UFA believed that farmers could maximize their incomes by exporting their wheat collectively through the Wheat Pool. When the global price of wheat collapsed in 1930 with the onset of the Great Depression, Alberta farmers were struck with economic misfortune. Unable to pay their taxes or repay their debts, many of them faced the possibility of foreclosure. The UFA responded by introducing the Debt Adjustment Act, which limited the ability of banks to foreclose on indebted farmers (Betke, 1979, p24-27). Most farmers preferred more radical solutions to their economic woes, however. Some of them called for a moratorium on tax and debt payments, which would have provided them with immediate financial relief. Others called for Alberta's monetary and banking system to be completely overhauled according to the principles of 'social credit', an idiosyncratic economic doctrine originating from Britain. This doctrine became popular in Alberta in the early 1930s due to the efforts of William Aberhart, a school principal and radio preacher (Caldarola, 1979, p39). For three years, Aberhart taught the basic tenets of social credit through his radio program, and organized study groups in Calgary where individuals could learn the intricacies of the doctrine. In 1935, Aberhart formed his own political party—the Social Credit Party—and was elected premier (Pal, 1992, p15).

The central claim of the social credit doctrine was that, in every capitalist society, workers do not earn enough money to purchase many of the goods that they want and need. This not only leads to material deprivation among workers, but also to crises of profitability among capitalist enterprises. To solve this problem of 'chronic underconsumption', the doctrine

proposes that the state or government-controlled banks give workers regular stipends or 'social credit dividends', thus boosting their incomes and purchasing power (Caldarola, 1979, p33). William Aberhart tried putting this doctrine into practice during his first few years in power, first by creating scrip money that could be given to workers and farmers as social credit dividends. This money was only usable within Alberta. He then tried bringing Alberta's private banks under the direct control of the state through the Alberta Credit Regulation Act, the Judicature Amendment Act, and other legislation (Caldarola, 1979, p42). These measures were heavily resisted by the banks and quickly struck down by the federal government. When Aberhart passed away in 1943, he was replaced by Ernest Manning, one of his most loyal protégés. Like his predecessor and mentor, Manning tried unsuccessfully to create a scrip currency, take over the banks, and provide social credit dividends to the people of Alberta. By the late 1940s, Manning realized the futility of creating a social credit system in Alberta, and moved his political party away from economic radicalism.

On February 13, 1947, an event occurred that forever changed Alberta's economic destiny. Imperial Oil, an American-owned oil company, discovered a large reserve of oil in Leduc, a small town just south of Edmonton (Knight, 1956, p300). Experts at the time estimated that the Leduc reserve contained approximately 100,000,000 barrels of oil, a far greater amount than any other reserve in Canada. Soon after this discovery, American and Canadian oil companies flocked to Leduc to clear land, drill oil wells, and conduct drill-stem tests. By the end of 1947, oil was being extracted from thirty-three wells in Leduc. Between 1947 and 1955, new oil reserves were discovered in other parts of Alberta, including Redwater, Golden Spike, Pembina, and Sturgeon Lake. These new reserves contained even more oil than the original Leduc reserve, which excited and invigorated the Alberta oil industry. Throughout this period, Canadian and

American oil companies invested over \$2 billion on oil exploration and extraction in Alberta, and built over 2,500 miles of oil pipelines (Knight, 1956, p302-311). Ernest Manning enthusiastically supported the growth and development of the Alberta oil industry. His government attracted American oil companies to Alberta by providing technical and geological data to American oil executives and by hosting oil conferences and symposiums (Sweeny, 2010, p86-88). The government also made it very easy for American oil companies to expropriate land in Alberta, sometimes at the expense of farmers and small landholders (Lizee, 2010, p81). Once American oil companies began drilling in Alberta, they were required to pay royalties to the provincial government. The government used this oil money to build roads and other infrastructure across the province, and also to fund education, healthcare, and social programs (Caldarola, 1979, p44).

Governance during the Social Credit era was highly centralized and even autocratic. William Aberhart exercised total control over the policymaking process, and refused to share decision-making power with caucus members, general party members, senior civil servants, and other stakeholders. While Manning was less dictatorial than Aberhart, he still had an imperious governing style:

“As a former high school principal, Aberhart ran his cabinet the way he ran his high school. Legendary for both his organizational abilities and his work ethic, Aberhart controlled every aspect of his party, government, and bureaucracy. This tradition continued under his successor, Ernest Manning. For twenty-five years Manning governed in a very personal fashion; no decision was ever taken without his knowledge and approval” (Brownsey, 2005, p210).

Under both Aberhart and Manning, the provincial cabinet was skeletal in its structure. It lacked policy committees, an administrative staff, and even a secretary. No records were kept of cabinet discussions, decisions, and votes (Pal, 1992, p20). Without basic institutional supports, cabinet ministers were unable to conduct independent policy research or put forward their own proposals. When the Progressive Conservative Party was elected to power in 1971, the provincial

cabinet became much more institutionally complex. Peter Lougheed, the leader of the Progressive Conservative Party and new premier, increased the number of cabinet ministers and introduced four policy committees: Agenda and Priorities, Economic Planning, Social Planning, and Intergovernmental Relations (Brownsey, 2005, p217). In addition, he required all Progressive Conservative caucus members (even those without cabinet positions) to participate in task forces, study groups, and standing committees within the legislature (Pal, 1992, p21). Through these reforms, Lougheed established a governance system that was much more formal, methodical, and decentralized than the one created by Aberhart and Manning. This new system was better equipped to deal with the needs and challenges of Alberta society, which was becoming increasingly urban and diverse.

Peter Lougheed was re-elected in 1975, with the Progressive Conservative Party winning 69 of 75 seats in the Alberta legislature. Soon after his landslide electoral victory, Lougheed began to carry out a large-scale industrial strategy, one which took advantage of rising oil prices and royalties. The centrepiece of this strategy was the creation of the Alberta Heritage Savings Trust Fund, a sovereign wealth fund that judiciously saved, managed, and invested the royalty money collected from oil companies. Under the close watch of the provincial cabinet, the Heritage Fund invested money in a number of economic development projects, including land reclamation, reforestation, affordable housing expansion, and health research (Collins, 1980, p161). The Heritage Fund also purchased bonds in the Alberta Energy Company and the Alberta Opportunity Company, two crown corporations that were recently established by the Progressive Conservative government (Chambers, Brisbois & Emter, 2014, p108). The Alberta Energy Company engaged in the extraction of natural gas, while the Alberta Opportunity Company provided loans to small businesses, especially those located in rural or low-population areas

(Davies & Yeboah, 1990, p160). Another crown corporation funded through the Heritage Fund was the Alberta Oil Sands Technology and Research Authority (AOSTRA), which developed new methods and techniques for extracting oil from the Alberta oil sands (Hastings-Simon, 2019). The ultimate goal of AOSTRA was to figure out how to extract bitumen, a thick low-grade crude oil, from deep reservoirs that were inaccessible through standard mining practices. In 1985, AOSTRA constructed an underground test facility in northeastern Alberta, an endeavour that cost the organization \$50 million. Inside the facility, engineers worked tirelessly to determine the effectiveness and reliability of 'steam-assisted gravity drainage' (SAGD), a novel and highly uncertain bitumen extraction method (Hastings-Simon, 2019, p12-13). This method involved softening bitumen through extremely high-pressure steam injections and then bringing the softened bitumen to the surface using submersible pumps (Sweeny, 2010, p134). AOSTRA did not test SAGD alone, but did so in partnership with a number of private oil companies, including Amoco Canada Limited, Imperial Oil Resources Limited, Syncrude, and Suncor (Howie, 2018, p121).

In 1987, engineers from AOSTRA and its partner organizations made a significant breakthrough in their SAGD testing project. After conducting a series of successful experiments in the underground test facility, they determined that SAGD was a viable method for obtaining bitumen from the oil sands. This achievement provided some hope and relief to Alberta's oil industry, which had suffered huge economic losses since 1980. These losses were attributable to both falling oil prices and the introduction of the National Energy Program, a federal economic program that inadvertently slowed down oil exploration in Alberta (Chastko, 2012, p173-174). Unfortunately, the oil industry did not quickly recover after the emergence of SAGD in 1987. In fact, the entire Alberta economy saw sluggish growth throughout the late 1980s (MacFaydan &

Watkins, 2014, p420). Don Getty, who became premier in 1985, tried in vain to restore strong economic growth through Keynesian fiscal policies. During his time in power, he engaged in a wild frenzy of public spending to resuscitate the economy, amassing \$15 billion of public debt in the process. This prodigal spending did little to improve Alberta's economic situation and was widely perceived as wasteful and reckless (Schwartz, 1997, p409). By the early 1990s, public opinion in Alberta had become hostile to large-scale government spending. When Ralph Klein replaced Don Getty as premier in 1992, he promised to restrain government spending and to reduce the provincial debt and budget deficit. To deliver on these promises, Klein slashed spending on healthcare and education and privatized a number of government services, such as property registration and vehicle registration (Dyck, 2008, p85-86). He also required all government departments to reduce their operating budgets by 20 percent and all civil servants to accept a 5 percent pay cut.

Like his predecessors, Klein was deeply committed to supporting the development and expansion of Alberta's oil industry. He hoped that Alberta would one day supplant Saudi Arabia as the primary supplier of oil to the United States and other parts of the world. Under his leadership, the provincial government quickly approved new oil extraction projects, often without conducting thorough environmental assessments. Alberta Environmental Protection, the government ministry responsible for imposing environmental standards on the oil industry, saw its budget cut and its staff size decrease (Adkin, 2016, p88-89). Oil companies that undertook new projects were practically exempted from paying royalties to the government, at least for a certain period of time (Sweeny, 2010, p130). Klein's *laissez-faire* environmental and royalty policies spurred rapid growth in the oil and gas sector, turning Alberta into a formidable player in the global oil market. This growth was also spurred by the widespread adoption of SAGD by

major oil companies. In the late 1990s, Suncor, ConocoPhillips, and other oil companies began using SAGD to extract bitumen from the oil sands in Athabasca, Cold Lake, and Peace River. Throughout the early 2000s, these companies spent approximately \$5 billion per year on SAGD projects and extracted about one million barrels of bitumen per day (Government of Alberta, 2006, p19-21).

As a neoliberal stalwart, Ralph Klein was reluctant to intervene heavily in the economy. Aside from creating a favourable royalty and regulatory regime for the oil industry, he was not very active in the realm of industrial policy. Unlike Peter Lougheed and Don Getty, he did not create new crown corporations, provide direct financial assistance to private enterprises, or try to steer economic activity in desired directions. While Klein's approach to economic policy was restrained and conservative, his approach to governance was radical and transformative. After gaining power, he established a highly centralized governance system by carrying out three institutional reforms (Brownsey, 2005, p218-223). First, he eliminated cabinet-level policy committees made up entirely of cabinet ministers, and replaced them with 'caucus committees' made up of both cabinet ministers and Conservative backbenchers. Under this new arrangement, cabinet ministers faced constant criticism and scrutiny from ambitious backbenchers, especially with regard to their ministerial budgeting decisions and planning processes (Schwartz, 1997, p413-414). Second, he fired senior ministerial staff who were non-partisan or politically neutral, and replaced them with party loyalists. Third, he appointed 'communications officers' to the various ministries. These officers reported directly to the Office of the Premier, allowing Klein to closely monitor and control the activities of each ministry. Taken together, these three reforms reduced the power and influence of cabinet ministers, stripped government ministries of their autonomy, and concentrated power in the hands of the premier.

Conclusion

Since Confederation, the federal government has played a very active role in the development and expansion of the Canadian economy. For over 150 years, it has supported and stimulated economic activity throughout the country using a variety of policy instruments, most notably tariffs, grants, price controls, and trade agreements. As we have seen, federal industrial policies have impacted almost every major industry in Canada, including manufacturing, agriculture (both land and water), health, energy, and information technology. In contrast, provincial industrial policies—specifically those in Ontario and Alberta—have impacted just a handful of industries. Some industries in Canada have benefitted from both federal and provincial policies. For example, in the early twentieth century, Ontario’s burgeoning manufacturing industry was protected from foreign competition by federal tariffs. At the same time, this industry was fuelled by cheap and reliable electric power from the Ontario Hydro-Electric Power Commission, a public utility company established by the Ontario government in 1906. Similarly, Alberta’s agricultural industry received substantial support in the 1920s from the National Research Council (NRC), a federal research agency. As we will recall, Alberta’s farmers overcame many challenges related to plant cultivation and animal breeding with the help of NRC-sponsored researchers. Alberta’s agricultural industry was also supported by the Alberta government through the creation of the Alberta Wheat Pool, the provision of farm subsidies, and other policy interventions. Interestingly, in 1931, the Canadian Cooperative Wheat Producers Ltd., an organization closely affiliated with the Alberta Wheat Pool, commissioned the National Research Council to fund research into animal nutrition (Estey, 1992, p125). This was not the only time in Canadian history when federal and provincial industrial policies directly intersected.

During their first few decades as provinces, Ontario and Alberta pursued much different industrial policy strategies, largely because they had different natural resource endowments. Ontario possessed dense pine and spruce forests, mineral-rich rock formations, and powerful bodies of water. As a result, economic activity and industrial policy in Ontario both centred around heavy industries, such as mining, smelting, lumber and pulp production, and manufacturing. Alberta, on the other hand, possessed large expanses of flat and arable land suitable for wheat, livestock, and dairy farming. Industrial policy in Alberta, therefore, tended to focus on promoting land cultivation and assisting farmers with the exporting and marketing of their agricultural products. When the Great Depression struck in 1930, Alberta was more deeply affected than Ontario. As the price of wheat and other agricultural products collapsed, Alberta's farmers lost their incomes, properties, and dignities. Out of desperation, they elected a new political party, the Social Credit Party, which promised to ease their economic hardships. The Social Credit Party subscribed to very unorthodox economic theories, and tried to reshape Alberta's monetary and banking system in accordance with these theories. There was no equivalent to the Social Credit Party in Ontario, where politicians and policymakers never deviated too much from economic orthodoxy. Soon after the second world war, Ontario and Alberta both developed new industrial specializations. In Ontario, automobile manufacturing became a very important industry, employing approximately 29,000 people and producing approximately 375,000 vehicles a year (Anastakis, 2013, p20). This industry was heavily supported by investment from American automobile companies, specifically Ford, General Motors, and Chrysler. As the automobile industry in Ontario took shape, other manufacturing industries in the province (food, chemicals, fabricated metals) continued to grow. In Alberta, meanwhile, the discovery of oil in Leduc, Pembina, and other parts of the province gave rise to a

massive oil, natural gas, and petrochemical industry. These developments had major implications for industrial policy in both provinces.

Starting in the 1960s, the provincial government of Ontario carried out a plethora of economic programs, including the Program to Encourage Product and Process Innovation, the Sector Partnership Fund, and the Ontario Automotive Investment Strategy. Many of these programs aimed to expand Ontario's manufacturing sector or to make this sector more innovative, adaptable, and resilient in the face of global competition. In contrast to the Ontario government, the Alberta government prioritized the oil and gas sector, which was (and continues to be) a major source of public revenue, employment, and prestige for Alberta. Ernest Manning, Peter Lougheed, and Ralph Klein all carried out programs designed to assist and nurture oil companies, whether by helping them acquire new lands for oil extraction, providing them with new extraction methods and technologies, or reducing the royalties and regulations imposed on them. We can clearly see, therefore, that industrial policy took different forms in Ontario and Alberta because these provinces had different industrial compositions. It would be wrong to suggest, however, that industrial policy in Ontario and Alberta bore no similarities whatsoever. In both provinces, public agencies were created to provide loans to small businesses (the Ontario Development Corporation, the Small Business Development Corporations, the Alberta Opportunity Company). This suggests that policymakers in both provinces shared a common interest in promoting entrepreneurship. In addition, a number of government programs were launched in both Ontario and Alberta to support high-tech or knowledge-intensive industries, such as medical technology and telecommunications. In Ontario, it will be recalled, some programs supported traditional manufacturing industries and knowledge-intensive industries simultaneously. Interestingly, the Ontario government created far more programs to promote

industrial innovation and R&D than the Alberta government. This is likely because Ontario has a more diverse industrial base than Alberta.

The governance systems of Ontario, Alberta, and the federal government share some common characteristics and have evolved in somewhat similar ways. In all three cases, governance passed through three distinct phases of evolution. During the first phase, the public decision-making process was informal and unsophisticated. Prime Ministers/premiers, cabinet ministers, and other policymakers made decisions haphazardly, often without following clear procedures or receiving guidance and support from policy experts and professional administrators. During the second phase, cabinets grew considerably in size, cabinet ministers formed their own policy committees, and executive branches acquired their own administrative staffs. As a result of these reforms, power was decentralized and the decision-making process became much more formal, structured, methodical. During the third phase, the decision-making process was greatly simplified and streamlined, as cabinet committees and administrative bodies were eliminated. At the same time, the balance of power shifted away from cabinets and government ministries and toward Prime Ministers/premiers and their close officials. Although Ontario and Alberta followed a similar evolutionary path, they did not always mirror each other perfectly. In fact, there were many instances throughout history when their governance systems diverged quite significantly. For example, in the 1920s, Alberta embraced a form of participatory democracy or direct democracy, while Ontario remained wedded to a conventional model of governance. Similarly, in the 1980s and early 1990s, Ontario's policymakers committed themselves to stakeholder engagement and collaborative decision-making, while those in Alberta did not. While political power was centralized in both provinces in the mid-1990s, this process went much further in Alberta under Ralph Klein than in Ontario under Mike Harris.

In summary, this chapter laid out the history of industrial policy and governance at the federal and provincial levels from the turn of the twentieth century to the turn of the twenty-first century. It showed how industrial policies at the federal level impacted all major industries, while those at the provincial level targeted a few specific industries. In Ontario, the government primarily focussed on mining, lumber, and manufacturing (especially automobiles), while in Alberta, the government focussed on agriculture and oil. It also showed how governance in Ontario and Alberta followed a similar evolutionary arc, but diverged in the 1920s and 1980s/1990s. In the next chapter, we will examine the various innovation network programs carried out by the federal government, Ontario government, and Alberta government since the 1980s. As we look at the design and structure of these programs, it is important to remember the historical narrative presented in this chapter. We must situate these programs within the context of industrial policy and governance. If the federal, Ontario, and Alberta governments pursue different innovation network programs, this may be explained by their different industrial policy and governance histories.

Chapter 6: A Survey of Federal and Provincial Innovation Network Programs

Since the 1990s, many Canadian scholars have studied innovation network programs at the federal and provincial levels. As the literature review in Chapter 3 shows, these scholars have kept the scope of their studies quite narrow and limited. Some have examined just one network program (Bell, 1996; Fisher, Atkinson-Grosjean & House, 2001; Doloreaux & Shearmur, 2018), while others have examined just a handful of related programs (Clarkson, 1999; Sa & Litwin, 2011). None have surveyed *all* network programs carried out by the federal government or a provincial government from the 1980s to the present day. This chapter attempts to catalogue and describe almost every network program implemented by the federal government, Ontario government, and Alberta government over the span of forty years. In doing so, it lays the groundwork for a comparison of federal and provincial approaches in Chapter 7. The chapter is divided into three sections which chronologically identify and describe federal programs, Ontario programs, and Alberta programs.

Federal Programs¹

Table 1: Federal Innovation Network Programs

ORGANIZATION	PROGRAMS
Ministries	
Industry, Science, and Technology Canada	<ul style="list-style-type: none">• Strategic Technologies Program (1988-1994)• Environmental Technology Commercialization Program (1988-1996)

¹ NOTE: All information about innovation network programs was derived from interviews with professionals across Canada, as well as documents published by federal and provincial ministries and agencies, local governments and economic development corporations, and technology incubators/accelerators and innovation hubs. In total, 41 individuals were interviewed and 309 documents were collected and analyzed.

Table 1: Federal Innovation Network Programs

ORGANIZATION	PROGRAMS
Industry Canada	<ul style="list-style-type: none"> • Technology Partnerships Canada (1997-2006)
Ministry of Innovation, Science, and Economic Development (ISED)	<ul style="list-style-type: none"> • Innovation Supercluster Initiative (2017-Present) • Strategic Innovation Fund (2017-Present) • Cyber Security Innovation Network Program (2019-Present)
Agencies/Nonprofits	
National Research Council (NRC)	<ul style="list-style-type: none"> • Industrial Research Assistance Program (1947-Present) • Technology Cluster Initiatives (2000-Present) • Communal Laboratories <ul style="list-style-type: none"> • Plant Biotechnology Institute (Saskatchewan) (1983) • Institute for Biodiagnostics (Manitoba) (1992) • National Institute for Nanotechnology (Alberta) (2001) • Aluminum Technology Centre (Quebec) (2002) • Canadian Photonics Fabrication Centre (Ontario) (2005) • Centre for Commercialization of Biomedical Technology (Manitoba) (2005) • Life Sciences Research Institute (Nova Scotia) (2007) • Biomedical Magnetic Resonance Imaging Research Laboratory (Nova Scotia) (2008) • Institute for Ocean Technology (Newfoundland)
Canada Foundation for Innovation (CFI)	<ul style="list-style-type: none"> • Institutional Innovation Fund (1998-2007) • New Opportunities Fund (1998-2007) • College-Industry Innovation Fund (2010-2022) • Major Science Initiatives Fund (2010-Present) • College Fund (2022-Present)
Genome Canada	<ul style="list-style-type: none"> • Various Funding Opportunities (2000-Present)
Sustainable Development Technology Canada (SDTC)	<ul style="list-style-type: none"> • Sustainable Development Technology Fund (2001-Present) • Seed Fund (2019-Present)
Mitacs	<ul style="list-style-type: none"> • Accelerate Fund (2003-Present) • Elevate Fund (2009-Present)
Granting Councils	

Table 1: Federal Innovation Network Programs

ORGANIZATION	PROGRAMS
Natural Sciences and Engineering Research Council (NSERC)	<ul style="list-style-type: none"> • Strategic Partnership Grants (1978-2018) • Networks of Centres of Excellence (1989-2019) <ul style="list-style-type: none"> • Business-Led Networks of Centres of Excellence (BL-NCE) (2007-2019) • Centres of Excellence for Commercialization and Research (CECR) (2007-2019) • Collaborative Research and Development Grants (1998-Present) • College and Community Innovation Program (2004-Present) <ul style="list-style-type: none"> • Applied Research and Development Grants • Idea to Innovation Grants • Engage Grants • Applied Research and Technology Partnership Grants • Technology Access Centres (Since 2009) • Alliance Grants (2019-Present)
Social Sciences and Humanities Research Council (SSHRC)	<ul style="list-style-type: none"> • Networks of Centres of Excellence (1989-2019) <ul style="list-style-type: none"> • Business-Led Networks of Centres of Excellence (BL-NCE) (2007-2019) • Centres of Excellence for Commercialization and Research (CECR) (2007-2019) • New Frontiers in Research Fund (2018-Present)
Medical Research Council	<ul style="list-style-type: none"> • Open Operating Grants Program (1960-1999) • Networks of Centres of Excellence (1989-2019, transferred to CIHR) • Collaborative Research Program (1993-1999)
Canadian Institutes of Health Research (CIHR)	<ul style="list-style-type: none"> • Networks of Centres of Excellence (1989-2019) <ul style="list-style-type: none"> • Business-Led Networks of Centres of Excellence (BL-NCE) (2007-2019) • Centres of Excellence for Commercialization and Research (CECR) (2007-2019) • Open Operating Grants Program (2000-Present) • Proof of Principle Program (2001-2015) • Industry-Partnered Collaborative Research Program (2011-2016) • Strategic Patient-Oriented Research Program (2011-Present)
Regional Development Agencies	

Table 1: Federal Innovation Network Programs

ORGANIZATION	PROGRAMS
The Federal Economic Development Agency for Southern Ontario (FedDev Ontario)	<ul style="list-style-type: none"> • Technological Innovation Program (2014-2018) <ul style="list-style-type: none"> • Advanced Manufacturing Fund (AMF) • Investing in Business Innovation (IBI) • Investing in Commercialization Partnerships (ICP) • Business Development Program (2014-2018) <ul style="list-style-type: none"> • Business Investment Sub-Program • Community Economic Development Program (2014-2018) <ul style="list-style-type: none"> • Regional Diversification Sub-Program • Regional Economic Growth Through Innovation (2018-Present) <ul style="list-style-type: none"> • Business Scale-Up and Productivity • Regional Innovation Ecosystem Sub-Program <ul style="list-style-type: none"> • Southern Ontario Network for Advanced Manufacturing Innovation (SONAMI)
Atlantic Canada Opportunities Agency (ACOA)	<ul style="list-style-type: none"> • Strategic Alliance and Consortia Formation Program (1994-?) • Atlantic Innovation Fund (2001-Present) • Business Development Program (2001-Present) • Springboard Atlantic (2004-Present) <ul style="list-style-type: none"> • FTE Contribution Program • Industrial Undergraduate Student Research Awards Program • Innovation Mobilization Program • Regional Economic Growth Through Innovation (2018-Present) <ul style="list-style-type: none"> • Business Scale-Up and Productivity • Regional Innovation Ecosystem Sub-Program
Western Economic Diversification Canada	<ul style="list-style-type: none"> • Western Diversification Program (1988-2020) <ul style="list-style-type: none"> • Knowledge Infrastructure Program • Technology Linkages • Regional Economic Growth Through Innovation (2018-Present, transferred to PrairiesCan and PacifiCan) <ul style="list-style-type: none"> • Business Scale-Up and Productivity • Regional Innovation Ecosystem Sub-Program
The Federal Economic Development Agency for Northern Ontario (FedNor Ontario)	<ul style="list-style-type: none"> • Regional Economic Growth Through Innovation (2018-Present) <ul style="list-style-type: none"> • Business Scale-Up and Productivity • Regional Innovation Ecosystem Sub-Program
PrairiesCan	<ul style="list-style-type: none"> • Regional Economic Growth Through Innovation (2018-Present) <ul style="list-style-type: none"> • Business Scale-Up and Productivity • Regional Innovation Ecosystem Sub-Program
PacifiCan	<ul style="list-style-type: none"> • Regional Economic Growth Through Innovation (2018-Present) <ul style="list-style-type: none"> • Business Scale-Up and Productivity • Regional Innovation Ecosystem Sub-Program

In the period following the Second World War, science and technology became the subject of increasing attention among policymakers, elected officials, and bureaucrats. National governments in both western and developing countries created new programs that supported large-scale, boundary-pushing science projects. They also sought to greatly enhance the scientific and technological capacity of universities and public research organizations (Freeman, 1995). It was common for governments to set up special ‘granting councils’ or ‘granting agencies’ dedicated to funding university research, allowing academic researchers to explore new scientific avenues without draining university budgets. These initiatives were carried out under the assumption that scientific advancement would naturally or automatically lead to technological development, economic growth, and military supremacy. Following this global trend, the Canadian federal government established three granting councils in the 1960s and 1970s: the Medical Research Council (MRC), the Natural Sciences and Engineering Research Council (NSERC), and the Social Sciences and Humanities Research Council (SSHRC). During their early years, the granting councils funded isolated research projects that were proposed and conducted by individual researchers or small teams of researchers. In the 1980s, they began funding multidisciplinary projects involving many researchers from different fields of study, as well as inter-sectoral projects involving actors from both the academic and private sectors (Bliss, 2000, p8). Towards the end of the decade, the federal government called upon the granting councils to fund large-scale innovation networks called Networks of Centres of Excellence (Government of Canada, 1989). These completely virtual networks brought together hundreds of researchers, graduate students, post-docs, and private sector partners across the country to advance scientific knowledge in various areas. Each network had a formal governance structure consisting of a Steering Committee, Scientific Director, and Network Manager (Networks of

Centres of Excellence, 2004, p10). The Networks of Centres of Excellence initiative represented the first attempt by the federal government to create innovation networks.

During the same year that the Networks of Centres of Excellence were established, the federal government announced the creation of a new ministry called the Ministry of Industry, Science, and Technology (Government of Canada, 1988). The purpose of the ministry was to help prepare Canadian industry to compete in the globalized, knowledge-based economy of the late twentieth century. In one of its early policy documents, the ministry recognized the importance of public-private collaboration in the area of science and technology:

“Increased cooperation between industry, labour, universities, colleges, and government is needed to ensure a maximum return on Canada’s science and technology investment. In the past there has been too much fragmentation in our efforts; Canada can no longer afford the resulting waste” (Industry, Science, and Technology Canada, 1991, p13).

In order to increase cooperation between innovative actors, the ministry introduced the Strategic Technologies Program. Ran from the ISTC office in Ottawa, this program helped private companies, universities, and public research institutions work together on the development of new information technologies, and on the application of existing information technologies. Through the program, the ministry partly subsidized the cost of technology feasibility studies conducted by industry-led alliances (Industry, Science, and Technology Canada, 1993, part 3 page 3). In 1996, the ministry was transformed into a new entity called Industry Canada, which was even more committed to supporting collaborative research and innovation (Doern, Castle & Phillips, 2016, p32). John Manley, the minister responsible for Industry Canada, asserted that innovations can only succeed in the modern era if they are carried out collectively by different organizations (Manley & Cyr, 1999, p10-11). Under Manley’s forward-thinking leadership, Industry Canada established an agency called Technology Partnerships Canada, which provided loans to small technology companies. Loan recipients were encouraged (and expected) to partner

with larger, more established companies on innovative projects (Technology Partnerships Canada, 1998).

During the era of Jean Chretien, the federal government realized that Canadian researchers in post-secondary institutions lacked the equipment and infrastructure needed to conduct world-class research. To rectify this problem, the government established a new agency called the Canada Foundation for Innovation (CFI). In a basic sense, CFI provides grants to colleges and universities to allow them to purchase new infrastructure (Canada Foundation for Innovation, 2002). Some examples of infrastructure funded by CFI include microscopes, telescopes, computers, biomedical imaging systems, RNA sequencers, and advanced manufacturing equipment. CFI grants cover forty percent of the cost of new infrastructure, while the remaining sixty percent is covered by provincial governments, nonprofit organizations, and private companies that are partnered with colleges and universities. According to a member of CFI interviewed for this study, some of the infrastructure co-funded by CFI may be used by both academic researchers and industrial researchers from the private sector (Program Officer 7). For example, an electron microscope acquired by a university through a CFI grant may be used by academic researchers to study viral growth and reproduction, and also by industrial researchers to characterize synthetic materials for new products. Occasionally, academic and industrial researchers help each other generate new knowledge and develop new technologies using CFI-funded equipment. It is important to note that CFI primarily funds equipment rather than buildings or facilities. This was made clear by the interviewee:

“An institution, let’s say York University, wants to build an advanced social sciences research facility that uses behavioural databases and so on. We won’t fund the building, but we may fund the fitting of the room in which the equipment that holds the databases and terminals and so on exist. Any of that equipment, we’ll probably fund up to forty percent of that. We do some bricks-and-mortar, but we’re mostly into the equipment that’s in the bricks-and-mortar” (Program Officer 7).

In the year 2000, the federal government decided to transform the Medical Research Council (MRC), one of Canada's three federal granting councils, into the Canadian Institutes of Health Research (CIHR). Like its predecessor organization, the CIHR funds research projects related to human health, but on a much larger scale and with much greater emphasis on networking and collaboration. The organization is made up of thirteen 'institutes', with each one focusing on solving a particular medical challenge, such as addiction, genetic diseases, and diabetes (Canadian Institutes of Health Research, 2004, p9). The institutes do not possess their own buildings or offices, but are completely virtual in nature, allowing them to keep their overhead expenses low. The projects funded by the CIHR institutes bring together researchers from universities, nonprofit research institutions, and research hospitals located in different provinces. Inter-provincial research is also supported by Genome Canada, a federal agency that was created the very same year as CIHR. Genome Canada was established by Industry Canada in order to prevent Canada from lagging behind other countries in the area of genomics, a branch of molecular biology. During its first year of operation, Genome Canada created five regional genome centres: Genome BC, Genome Prairie, Ontario Genomics Institute, Genome Quebec, and Genome Atlantic. The regional centres are not subsidiaries of Genome Canada, but rather are completely independent organizations. Every year, Genome Canada establishes national priorities for genomics research, and offers to fund research projects that are aligned with these priorities. Once Genome Canada announces a funding competition, the regional genome centres bring together genomics researchers from different organizations to form strong research teams. With assistance from various technical experts, these teams develop compelling research proposals, and then submit these proposals to Genome Canada for evaluation (Program Officer

3). The teams with the strongest proposals are awarded funding. Many research teams include genomics researchers from multiple provinces.

To obtain information about the regional genome centres, interviews were conducted with members of two of these centres: Genome Alberta and Genome Atlantic. According to these members, many of the research teams assembled by the regional centres not only include researchers from the academic and nonprofit sectors, but also from the private or industrial sector. Moreover, many of the projects undertaken by these teams are aimed at addressing the needs of industry. For example, one of the teams assembled by Genome Atlantic is trying to discover ways to slow down the corrosion of oil pipelines, while another is trying to increase the resistance of farm-bred mussels and other shellfish to climate change. Academic and industrial researchers contribute equally to the completion of these projects by designing and carrying out experiments, establishing benchmarks for success, and measuring progress as the projects move forward (Program Officer 2). All researchers are bound by Strategic Alliance Agreements, which determine “how information is going to be shared amongst the researchers and participants, and what the rules are around how to use that information” (Director 2). Communication between researchers often occurs virtually or electronically, as researchers are based in different organizations across Canada.

The National Research Council (NRC) is Canada’s oldest and perhaps most prestigious public research institution. Created by the federal government in 1916, the NRC has conducted important research in a range of different scientific fields, from physics and chemistry to marine biology and nanotechnology. In the 1990s and 2000s, the NRC underwent a massive expansion, as it established new research laboratories across Canada. Employing hundreds of scientists and graduate students, these laboratories generate both fundamental scientific knowledge and new

technology, some of which has commercial or industrial applications. Small technology companies are able to operate or ‘incubate’ inside these laboratories, where they have access to office and research space, advanced scientific equipment, and world-class scientific expertise (National Research Council, 2008, p27). If NRC scientists develop technologies with strong commercial potential, then they license these technologies to the companies incubating inside NRC labs. As part of its mandate, the NRC tries to foster connections between its laboratories and other innovative organizations, whether these organizations are private, academic, or nonprofit:

“In each community where they are located, NRC’s laboratories are integrated with local academic institutions through joint appointments, research publications, and the training of students from high school onward. Ties with small and medium-sized business are forged through not only the incubation sites but also through guest workers, direct consultations, patent transfers, spin-offs, and Canada-wide consultations through Industry Technology Advisors operating under its Industrial Research Assistance Program” (White & Gunther, 2001, p28)” (White & Gunther, 2001, p28).

The NRC views its laboratories not only as knowledge-generating bodies, but also as the central hubs of local innovation clusters. Part of their function is to support, encourage, and galvanize other innovative organizations in their local environments. Since the early 2000s, the NRC has hosted workshops and conferences on the topic of cluster-building and cluster-expansion. These events are attended by NRC representatives, entrepreneurs, educators, investors, and community leaders throughout the country (National Research Council, 2005, p6).

The year 2006 marked a shift in political climate at the federal level, as the Conservative Party of Stephen Harper superseded the Liberal Party of Paul Martin. Although the Conservative Party departed philosophically from its rival in many respects, it was equally committed to promoting collaboration between universities, colleges, entrepreneurs, and established businesses. Upon gaining power, the Harper Conservatives proceeded to introduce a slew of new

innovation network programs, as well as modify and expand existing programs. Most notably, the Conservatives expanded the Networks of Centres of Excellence (NCE) program. With an additional \$100 million investment, the NCE program began funding two new types of network: Business-Led Networks of Centres of Excellence (BL-NCE) and Centres of Excellence for Commercialization of Research (CECR). Unlike the original NCE networks from the 1980s and 1990s, which focused on basic or fundamental research, the BL-NCE and CECR networks focused on applied research. They brought together post-secondary institutions and private companies to develop new products, services, and technologies that can be readily commercialized (Networks of Centres of Excellence Canada, 2013, p17-19; Performance Management Network Inc., 2013, piii). This kind of public-private collaboration was also greatly supported by CFI during the Harper years. Through its College-Industry Innovation Fund, CFI helped Canadian colleges obtain new research equipment, with the expectation that they would use this equipment to directly assist private companies with the design, prototyping, and testing of new products (Canada Foundation for Innovation, 2022a). CFI also introduced a program that partially covered the operating and maintenance costs of large research facilities in Canada (Canada Foundation for Innovation, 2022b).

As one of Canada's three federal granting councils, NSERC has invested hundreds of millions of dollars into science and technology projects throughout Canada. Some of these projects have been carried out by individual researchers or organizations, while others have been carried out by small and large groups of innovative organizations. During the era of Stephen Harper, NSERC introduced a series of new grants designed to encourage public-private collaboration. The most notable of these grants are the Engage Grants, Applied Research and Development (ARD) Grants, and Applied Research and Technology Partnership Grants. Engage

Grants fund small-scale projects involving one company and one college or university, while ARD Grants fund large-scale projects involving multiple companies and post-secondary institutions (Natural Sciences and Engineering Research Council, 2022; Program Officer 1). The recipients of these grants are expected to share knowledge, equipment, and facilities as they create a new technology or solve an industry-wide or sector-wide problem. In 2010, NSERC started providing funds to colleges across the country to help them set up and operate small laboratories called Technology Access Centres (TACs). These laboratories do not conduct basic or fundamental research, but rather provide testing, prototyping, and training services to small and early-stage companies. Each TAC employs a team of researchers, engineers, and students that assesses the technical needs of client companies and uses its expertise and equipment to help these companies reach new technical milestones. One notable TAC is the Canadian Food and Wine Institute, which is located on the campus of Niagara College. With 1,300 square feet of cooking and brewing space, and a team of well-trained student researchers, this laboratory allows small companies to develop experimental food and beverage products. It should be noted that TACs are not technology incubators, as they do not allow client companies to become tenants or residents. Since their creation in 2010, many TACs have grown considerably in size, with some of them taking over entire buildings on or near college campuses (Director 6). While NSERC is an important source of funding for TACs, it is not the only source. Most TACs also receive funding from CFI, especially if they are in the process of expanding or acquiring new equipment. They also generate their own revenue by charging companies fees for their services. According to one manager of a TAC (Manager 4), NSERC funding covers engineer and manager salaries, while user fees cover building maintenance and upkeep costs. There are currently sixty TACs throughout Canada.

As we saw in Chapter 4, the federal government has created a number of Regional Development Agencies (RDAs) dedicated to supporting economic growth in different regions. The first RDA was the Department of Regional Economic Expansion (DREE), created in 1969 under the leadership of Pierre Trudeau. In 1987, DREE (then called DRIE) was dismantled, and three new RDAs were created: Western Economic Diversification (WD), the Atlantic Canada Opportunities Agency (ACOA), and the Federal Economic Development Agency for Northern Ontario (FedNor). Over the next few decades, the number of RDAs increased to seven. With many offices scattered across the country, the seven RDAs provide capital to small businesses, build vital community infrastructure, and attract foreign investment to the regions they oversee. They also try to bring companies, universities, and other organizations together to stimulate innovation. For example, in 2001, ACOA launched the Atlantic Innovation Fund, which aimed to “strengthen the region’s innovation capacity by supporting research, development, and commercialization partnerships and alliances among private sector firms, universities, research institutions, and other organizations in the Atlantic system of innovation” (Atlantic Canada Opportunities Agency, 2010, p8). Through this program, ACOA provided money to colleges and universities in the Atlantic provinces, allowing these institutions to hire Industry Liaison Officers and Technology Transfer Officers (Springboard Atlantic, 2012, p7). These individuals are responsible for establishing connections between post-secondary institutions and private companies, and for transferring knowledge and intellectual property from the academic sphere to industry. Like ACOA, WD provided money to post-secondary institutions. Some institutions used this money to purchase advanced research equipment, while others used it to build new research facilities or expand existing facilities. WD claimed that the research facilities it helped create in western Canada gave researchers “the ability to integrate activities in one physical

space, improving research efficiency and enhancing networking and collaboration” (Western Economic Diversification Canada, 2011, p42). It is unclear, however, whether these facilities are shared by academic and industrial researchers, and whether they also receive provincial funding or private funding.

The Federal Economic Development Agency for Southern Ontario (FedDev) is an RDA created by the federal government in 2009 in order to help southern Ontario “recover from the effects of the global economic recession and set the foundation for prosperity going forward” (Federal Economic Development Agency for Southern Ontario, 2010, p3). Throughout its twelve years of operation, FedDev has sought to spur innovation in southern Ontario by directly investing in small innovative businesses and providing them with advice, mentorship, and strategic connections. The agency has also provided funding to technology incubators/ accelerators and innovation hubs, allowing these organizations to deliver programs that support entrepreneurs in different ways (Federal Economic Development Agency for Southern Ontario, 2016, p22-29). For example, in 2016, FedDev gave money to Communitech, a large and well-established innovation hub in Waterloo. Communitech used this money to create the Fierce Founders Program, which helps women and non-binary entrepreneurs grow their businesses through a combination of grants, coaching, and intensive training (Federal Economic Development Agency for Southern Ontario, 2017, p32). The very same year FedDev invested in Communitech, it also helped create a virtual innovation network called the Southern Ontario Network for Advanced Manufacturing Innovation (SONAMI). This network consists of eight colleges and one university, all of which are located in southern Ontario. The purpose of the network is to help small manufacturing companies develop new products, integrate new technologies into their production systems, and devise marketing strategies. Each institution

within the network provides client companies with specialized services, including workflow analysis, materials testing, design validation testing, high fidelity scanning, image processing, and 3D printing. According to a representative of the network, client companies often migrate from one institution to another as they progress along the path of innovation (Director 7). There is very little direct collaboration between the institutions, however FedDev is encouraging them to work together in a more structured way to support client companies.

When Justin Trudeau became prime minister in 2015, he established the Ministry of Innovation, Science, and Economic Development (ISED), selecting Navdeep Bains to lead the new ministry. Like previous economic ministries, ISED is responsible for funding and overseeing various federal agencies that deal with innovation and economic development. The granting councils, the RDAs, Genome Canada, and CFI all fall under the purview of ISED. In addition to presiding over federal agencies, ISED carries out its own innovation programs, some of which support innovation networks and clusters. One of these programs, the Strategic Innovation Fund (SIF), provides both repayable loans and non-repayable grants to research consortia across Canada. These consortia are made up of small enterprises, universities, colleges, and nonprofit research institutions. All consortia members are expected to collaborate on the development and demonstration of new products. In one of its reports, ISED states that one of the goals of the SIF is to address the ‘collaboration gap’ that exists within Canada:

“Innovation thrives when companies, investors, and universities collaborate to grow businesses, commercialize inventions, and create new ventures. Despite Canada’s strong talent base, large firms, SMEs, and research infrastructure, these stakeholders are not collaborating sufficiently, which inhibits commercialization of R&D. In 2017, Canada ranked 18th among OECD countries by university-industry collaboration. To address this collaboration gap, the SIF includes collaboration requirements in the majority of its contribution agreements” (Ministry of Innovation, Science, and Economic Development, 2021, p26).

Within any given research consortium, there is one member organization that is responsible for receiving and allocating SIF funds, coordinating research projects, and reporting research outcomes and results to ISED. Consortia may use SIF funds to hire personnel, purchase materials and equipment, and improve research facilities and other infrastructure (Ministry of Innovation, Science, and Economic Development, 2017, p5).

The most ambitious innovation program carried out by ISED is the Innovation Supercluster Initiative (ISI), which was launched in 2017 with a budget of \$950 million. The ISI created five virtual innovation networks, referred to as ‘clusters’ or ‘superclusters’ (Ministry of Innovation, Science, and Economic Development, 2019, p45). These five networks include the Digital Technology Cluster (based in British Columbia), the Protein Industries Cluster (based in Alberta, Saskatchewan, and Manitoba), the Advanced Manufacturing Cluster (based in Ontario), Scale AI (based in Quebec), and the Ocean Cluster (based in Atlantic Canada). Each network or supercluster specializes in a different area of technology. For example, the Digital Technology Cluster specializes in data analytics and cloud computing, while the Ocean Cluster specializes in aquaculture technology and marine vehicles. Any innovative organization in Canada is able to join a supercluster, as long as it has competencies in a certain technological area, and is willing to pay the requisite membership fees. On average, the superclusters have between 300 and 500 member organizations, which include small companies, large multinational corporations, universities, colleges, incubators, accelerators, and nonprofit research institutions. The superclusters are governed by boards of directors and managed by teams of executives and administrators.

The ultimate goal of the ISI is to make Canada a global technological leader by “encouraging large-scale collaboration between innovation ecosystem players” (Ministry of

Innovation, Science, and Economic Development, 2017, p5). Each supercluster has systems in place that bring member organizations together and encourage them to carry out joint R&D projects. These systems were described by two interviewees who are closely involved in the management of superclusters. One way in which the superclusters foster collaboration between member organizations, according to the interviewees, is by hosting annual general meetings, networking events, and pitching events. These gatherings allow representatives from different organizations to meet each other, share knowledge and information, and learn about each other's technical abilities and needs (Program Officer 5). During pitching events, some members describe the technical challenges they are currently facing, and then seek out partners who can help solve these challenges. Other members describe new technologies they have created, and then seek out partners who can use these technologies to solve problems. All events are held in rented or borrowed venues, as the superclusters do not own their own buildings or facilities. Another way in which the superclusters foster collaboration is through the use of online tools. For example, most superclusters have portals on their websites which are only accessible to members. These portals contain many useful resources, such as membership lists, detailed member profiles, IP (intellectual property) registries, and virtual forums. Members often use these portals to find potential partners and collaborators (Director 3). It should be noted that, in the summer of 2022, the superclusters were rebranded as 'Global Innovation Clusters' (Silcoff, 2022).

Ontario Programs

Table 2: Ontario Innovation Network Programs

ORGANIZATION	PROGRAMS
Premier's Council on Science and Technology	• Ontario Centres of Excellence Program (1986-2004)

Table 2: Ontario Innovation Network Programs

ORGANIZATION	PROGRAMS
Various Ministries (Energy, Science & Technology; Training, Colleges & Universities; Economic Development & Trade)	<ul style="list-style-type: none"> • Sector Partnership Fund (1992-1996) • R&D Challenge Fund (1997-2002)
Technology Ontario	<ul style="list-style-type: none"> • Industry Research Program (1993-1998)
Ontario Innovation Trust	<ul style="list-style-type: none"> • Infrastructure Grants (1999-2009)
Ministry of Research and Innovation	<ul style="list-style-type: none"> • Ontario Research Fund (2006-Present, transferred to MEDJCT) • Regional Innovation Centres (2010-Present, transferred to MEDJCT) <ul style="list-style-type: none"> • HalTech Innovation Centre (Burlington) • Innovation Guelph (Guelph) • Innovation Factory (Hamilton) • Launch Lab (Kingston) • Communitech (Kitchener) • TechAlliance of Southwestern Ontario (London) • VentureLab (Markham) • Research Innovation Commercialization Centre (Mississauga) • Innovation Initiatives Ontario North (North Bay) • Spark Centre (Oshawa) • Invest Ottawa (Ottawa) • Sault St. Marie Innovation Centre (Sault St. Marie) • Innovation Niagara (Niagara) • NORCAT Innovation (Sudbury) • Northwestern Ontario Innovation Centre (Thunder Bay) • MaRS Discovery District (Toronto) • WeTech Alliance (Windsor) • Jobs and Prosperity Fund (2013-2016) <ul style="list-style-type: none"> • New Economy Stream • Strategic Partnership Stream • Youth Skills Connections (2014-2018)
Ministry of Economic Development, Job Creation, and Trade (MEDJCT)	<ul style="list-style-type: none"> • Ontario Research Fund (2006-Present) • Regional Innovation Centres (2010-Present)

Table 2: Ontario Innovation Network Programs

ORGANIZATION	PROGRAMS
Ontario Centre of Innovation (OCI, formerly OCE)	<ul style="list-style-type: none"> • College Partnerships Program (2004-?) • Connections Program (2006-2012) • Connected Vehicle/Automated Vehicle Program (2013-2016) • Collaboration Voucher Program (2013-Present) <ul style="list-style-type: none"> • Voucher for Innovation and Productivity • Voucher for Commercialization • Voucher for E-Business • Voucher for Industry Association R&D Challenge • Campus-Linked Accelerator Program (2014-2018) • On-Campus Entrepreneurship Activities (2014-2018) • Alberta-Ontario Innovation Program (2014-2018) • Autonomous Vehicle Innovation Network (AVIN) (2016-2021) <ul style="list-style-type: none"> • Regional Technology Development Sites • AV Research and Development Partnership Fund • TargetGHG Program (2016-2017) • IBM Innovation Incubator Project (2016-2017) • Colleges Applied Research and Development Fund (2017-2019) • Ontario Vehicle Innovation Network (OVIN) (2021-Present) <ul style="list-style-type: none"> • Regional Technology Development Sites • AV Research and Development Partnership Fund
Northern Ontario Heritage Fund Corporation	<ul style="list-style-type: none"> • Infrastructure and Community Development Program (2005-2014) • Strategic Economic Infrastructure Program (2013-2020) • Northern Innovation Program (2013-2020) • Invest North Program (2020-Present) <ul style="list-style-type: none"> • Innovation Stream • Industrial Research Chairs Initiative • Community Enhancement Program (2020-Present)

In 1876, the Canadian federal government introduced the National Policy, which sought to stimulate industrial development in Canada by imposing tariffs on foreign manufactured goods. Over the next one hundred years, industrial factories proliferated in Canada, with most of them being established in the province of Ontario (Smardon, 2014, p51-98). Throughout this period of ‘Fordist industrialization’, Ontario became the undisputed manufacturing heartland of Canada. Starting in the mid-1970s, however, Ontario’s manufacturing sector came under tremendous pressure, as globalization, free trade, and rapid technological change created massive uncertainty for Ontario’s manufacturers (Clarkson, 1999, p86). Faced with increasing global

competition, many manufacturers considered relocating their factories outside the province (High, 2003, p167-191). Hundreds of thousands of workers in the manufacturing sector were threatened with layoffs, as manufacturers rationalized, simplified, and downsized their operations. The provincial government of Ontario feared that the loss of manufacturing would precipitate an economic crisis. Many policymakers believed that, in order for Ontario's economy to continue to grow and generate employment, new industrial sectors would need to be created. Ideally, these new sectors would be based on emerging technologies, such as information technology, communication technology, biotechnology, photonics, and digital media.

Between the years 1985 and 2002, the Ontario government was led by three different political parties, all of which were determined to support the creation and expansion of high-tech industries. To achieve this aim, they sought to forge stronger linkages between Ontario's business community, universities, colleges, and research institutions. It was believed that public-private collaboration would lead to the transformation and modernization of Ontario's economy, allowing it to thrive in an era of globalization and high technology. Under the Liberal Party of David Peterson (1985-1990), the provincial government launched the Ontario Centres of Excellence (OCE) program, which funded seven research consortia throughout the province. These consortia included both academic and industrial members, and conducted fundamental scientific research that was relevant to industrial needs and interests (Bell, 1996, p328). When the Liberal Party was replaced by the NDP in 1990, the government continued to support collaborative innovation by introducing the Sector Partnership Fund (SPF). This was followed in 1997 by the Research and Development Challenge Fund, which partially funded research projects involving both public and private actors (Fattori, 1999). Most projects co-funded through the Challenge Fund were in the biomedical and healthcare fields. All three programs

promoted *virtual* innovation networks; they did not fund the construction or operation of physical innovation spaces.

With the election of Dalton McGuinty as Premier of Ontario in 2003, the provincial government became much more driven in the pursuit of its innovation agenda (Sharaput, 2012, p255). During his second year in office, McGuinty established a new ministry called the Ministry of Research and Innovation (MRI), giving it an annual budget of \$260 million. One of the signature programs carried out by MRI was the Ontario Research Fund, which helped academic researchers in the province acquire new research equipment and infrastructure through co-financing arrangements (Ministry of Research and Innovation, 2014). This program essentially served the same function as CFI at the federal level. Another notable program was the Jobs and Prosperity Fund, which had three different funding streams. One of these streams, the Strategic Partnerships Stream, sought to “help entrepreneurs, companies, research institutions, customers, and investors work together to strengthen Ontario firms and our ability to compete globally” (Ministry of Research and Innovation, 2015). The Jobs and Prosperity Fund not only invested in virtual innovation networks, but also in physical innovation spaces, such as technology incubators and accelerators. In 2016, Johnson & Johnson Corporation announced that it would build a life sciences incubator in downtown Toronto called JLABS Toronto. This incubator would be capable of housing up to fifty life sciences companies, giving them access to sophisticated equipment and laboratory space. MRI supported this project financially through its Jobs and Prosperity Fund, investing \$20 million into the creation of JLABS Toronto (Ministry of Research and Innovation, 2016).

As part of its innovation strategy, the McGuinty government oversaw the complete overhaul of the Ontario Centres of Excellence (OCE) program. Instead of funding several

research consortia, the program would now fund a single organization called OCE Inc. This organization is registered as an Ontario nonprofit corporation, and is governed by an independent board of directors. Since it was founded in 2004, OCE Inc. (now called OCI) has been responsible for delivering various innovation programs on behalf of the provincial government. Many of these programs are aimed at strengthening Ontario's innovation ecosystem by creating a bridge between the province's academic/educational sector and industrial sector. For example, the Connections Program and Colleges Applied Research and Development Fund both give post-secondary students in Ontario opportunities to work directly with private companies on applied R&D projects (Ontario Centres of Excellence, 2009, p17). Students who participate in these programs are often hired by the companies they worked with after they graduate. In 2013, OCE Inc. launched the Collaboration Voucher Program, which gives small and medium-sized companies vouchers, or tokens, that they can use to purchase services from universities, colleges, and research hospitals: "Eligible Ontario companies receive a voucher, or credit, that can be redeemed for expertise and resources from Ontario universities, colleges, and research hospitals to advance productivity and commercialization" (Ontario Centres of Excellence, 2013, p23). Depending on its needs, a company receives a voucher of a certain monetary value. If a company needs help setting up an E-commerce website, for example, then it receives a voucher worth \$2,500. Alternatively, if it needs help developing a new product or production process, then it receives a voucher worth \$20,000.

One year after launching the Collaboration Voucher Program, OCE Inc. introduced another large-scale innovation program, this one aiming to support young, aspiring entrepreneurs. With a budget of \$43 million, the Campus-Linked Accelerator Program helped establish business incubators and accelerators on every university and college campus in Ontario

(Ontario Centres of Excellence, 2017, p16). These incubators and accelerators provide mentorship, networking opportunities, equipment, and work space to students who wish to start their own businesses. They are places where young entrepreneurs can develop their ideas, interact with peers, and connect with other innovative actors in their local communities. They possess many physical assets, such as work desks, meeting rooms, auditoriums, and testing facilities. Martin Croteau, a Professor at Toronto Metropolitan University, described these incubators and accelerators in a report he wrote for the Incubate Innovate Network of Canada:

“By 2016, Ontario’s network included 59 campus-linked BAIs [business accelerators and incubators] involving 44 academic institutions across Ontario. In that year, these BAIs supported the creation of 1,276 startups in total. They managed facilities with a total capacity of over 550,000 square feet, including 2,400 desks, several meeting and collaboration spaces, and various large networking and event spaces. The network also included maker spaces as well as product development and testing facilities that housed over 1,000 specialized tools and pieces of equipment and 155 rapid prototyping machines” (Croteau, 2019, p6).

In 2018, OCE Inc. cancelled the Campus-Linked Accelerator Program, causing many on-campus incubators and accelerators to shut down. Some survived by securing replacement funding from their host colleges and universities (Incubator Manager 2; Incubator Manager 4).

While OCE Inc. seeks to support new high-tech industries, such as digital media and biotechnology, it also seeks to support one of Ontario’s oldest industries: the automobile industry. As we saw in the beginning of this section, Ontario’s automobile industry has struggled to remain competitive since the advent of globalization and free trade. The directors of OCE Inc. believe that, in order for this industry to regain its competitive strength, automobile manufacturers must embrace new technologies and new types of vehicles. Most importantly, they must begin producing autonomous vehicles—that is, vehicles that can operate without any driver or user input. It is predicted that, by the year 2030, the market for autonomous vehicles will be valued at over \$2 trillion (Business Wire, 2022). To promote the development and production of

autonomous vehicles in Ontario, OCE Inc. created the Autonomous Vehicle Innovation Network (AVIN), a province-wide innovation network that brings together automobile manufacturers, artificial intelligence (AI) companies, universities, transit agencies, infrastructure owner-operators, and other actors. AVIN is directed and overseen by an executive body drawn almost entirely from OCE Inc. The main purpose of the executive body is to foster collaboration between the different actors within the network. In an interview, an AVIN manager explained how the executive body brings actors together:

“The executive body of AVIN has a team called the ‘Central Hub’. The team’s role is to be the connector and the coordinator of Ontario’s automotive and mobility cluster. Within that team there are some folks called sector managers or sector development managers. What they do is, they’re on the ground connecting people. So for example, a startup or a small or medium-sized enterprise in our province may come to us and say ‘hey, I’ve got an AI solution, and I see an application in the movement of people and goods in the auto sector and the transportation sector. Who can you connect me with?’ That team gets to work and makes those connections, makes the phone call. They know who’s doing what in the province, and they’re piecing those together themselves” (Manager 1).

If a tech company in Ontario is having difficulty developing an algorithm for autonomous vehicles, then it may approach an AVIN sector manager for assistance. During its meeting with the manager, the company may be referred to academic or commercial partners that have the expertise it needs. Of course, the AVIN executive body does more than just provide referral services. It also funds six autonomous vehicle research facilities throughout the province called Regional Technology Development Sites (Ontario Centres of Excellence, 2018, p5). These facilities contain equipment and infrastructure that can be used by entrepreneurs and academic researchers to develop new autonomous vehicle technologies. For example, the facility in Ottawa contains a driving track that is equipped with special sensors, GPS and satellite systems, and cloud computing capabilities. The Regional Technology Development Sites receive funding from both the AVIN executive body (through OCE Inc.) and private companies.

In 2011, the provincial government of Ontario announced that it would establish technology incubators called Regional Innovation Centres (RICs) across the province. Soon after this announcement, seventeen RICs were created in various cities, including Guelph, Windsor, Burlington, Oshawa, Hamilton, Sault Ste. Marie, and Thunder Bay. The provincial government did not create these incubators alone, but did so with the help of universities, municipal governments, local chambers of commerce, and local economic development corporations (Director 4). In many cities, RICs spawned from existing organizations, such as industry associations and business advocacy groups. In some cities, existing technology incubators simply morphed into RICs, or received RIC designations. For example, in the city of Waterloo, the Communitech incubator (founded in 1997) became the RIC for the Waterloo area after submitting an application to the provincial government (Incubator Manager 6). All RICs are nonprofit organizations dedicated to helping entrepreneurs develop effective business plans, network with other innovative actors, and secure funding for their business ventures. They receive operational funding from the provincial government, and are governed and managed by business and community leaders in each city where they are located. Unlike the on-campus incubators discussed earlier, which primarily support student entrepreneurs, the RICs support entrepreneurs of all types, regardless of their level of experience or the developmental stage of their business.

One of the primary functions of RICs is to provide mentorship and counselling to entrepreneurs. Each RIC employs professional business advisors, who guide entrepreneurs through the process of incorporation, business model canvassing, budgeting, and venture capital pitching (Incubator Manager 5). The advisors also connect entrepreneurs to other actors in the innovation ecosystem, such as academic researchers, student interns, and lawyers specializing in

intellectual property. If entrepreneurs have advanced beyond the startup stage, and are ready to sell products, then advisors may introduce them to potential customers. In addition to providing mentorship, the RICs also provide private office, co-working, and laboratory space. In an interview, an incubator manager described the physical layout of one RIC, which consists of three different areas (Incubator Manager 6). The first area contains private offices that entrepreneurs can rent on a long-term basis. The second area contains a co-working space with an open-concept design, a communal kitchen and lounge, and a large room that can be used for workshops and networking events. Finally, the third area is a ‘wet laboratory’ that is specifically tailored to the needs of life sciences companies. This 1,000 square foot laboratory is equipped with fume hoods, eye wash stations, and other equipment that life sciences companies need in order to conduct R&D. According to the interviewee, these three areas provide fertile ground for collaboration between entrepreneurs.

The most prominent and influential RIC is the MaRS Centre, which is located in the Discovery District of downtown Toronto. The MaRS Centre greatly surpasses other RICs in terms of size and scale, as it contains 1.5 million square feet of office and laboratory space, and houses approximately 150 tenant organizations. These organizations are not just small business ventures, but are also nonprofit research institutions, venture capital firms, and branches of large multinational corporations. JLABS Toronto, the life sciences incubator discussed earlier in this section, has been a MaRS tenant since it was founded in 2016. The MaRS Centre considers itself to be a ‘convergence centre’—that is, a place where innovative organizations of different kinds come together or ‘collide’, share ideas and resources, and help each other carry out groundbreaking innovations. In its marketing materials, the MaRS Centre claims that inter-organizational networking and collaboration frequently takes place under its roof:

“As their own companies mature and bring products to market, MaRS’ tenants are able to meet other likeminded entrepreneurs housed under the same roof. Co-location at MaRS has been identified as a catalyst in helping ventures to attract talent, effectively collaborate with like organizations, bolster public relations and prominence in the media, and leverage the culture of innovation. A curated set of tenants who are open to a symbiotic relationship has had a magnet effect for ventures and global enterprises wanting to be a part of this unique ecosystem” (MaRS Discovery District, 2018, p26).

The immense size and financial capacity of the MaRS Centre has allowed it to assume a leadership role among the RICs (Remers et al. 2017, p21). This leadership takes different forms. For example, the MaRS Centre occasionally plans and coordinates activities that span the entire RIC network. It also measures and evaluates the performance of other RICs through its Data Catalyst Program, and provides funding to business ventures in other RICs through its Investment Accelerator Fund.

Since 1988, the Ontario government has funded and overseen an agency called the Northern Ontario Heritage Fund Corporation (NOHFC), which aims to “promote and stimulate economic development initiatives in Northern Ontario by providing financial assistance to projects that stabilize, diversify, and foster the economic growth and diversification of the region” (Northern Ontario Heritage Fund Corporation, 2013, p5). The jurisdiction of NOHFC is quite large, extending from Sudbury and Algoma up to Kenora and Red Lake. The agency has different funding programs, some of which support the creation of innovation networks. For example, the Invest North Program provides funding for R&D and commercialization projects undertaken by public-private partnerships in northern Ontario (Northern Ontario Heritage Fund Corporation, 2022a). The program also helps northern colleges and universities hire special faculty members called ‘industrial research chairs’, who assist private companies with their innovative endeavours. Part of NOHFC’s mandate is to fund the construction of infrastructure in northern Ontario communities. Most of this infrastructure consists of community necessities:

water treatment facilities, barns and greenhouses, tile drainage systems, sports stadiums, e-bike charging stations, airplane hangars, etc. (Northern Ontario Heritage Fund Corporation, 2022b). On occasion, the agency helps construct infrastructure related to innovation, such as research laboratories and technology incubators/accelerators. In 2018, the agency contributed to the creation of the Centre for Advanced Studies in Engineering and Sciences (CASES), a large innovation hub located on the campus of Lakehead University (Lakehead University, 2018). This 42,000 square foot building houses a number of research laboratories, a support centre for Indigenous students, and a technology incubator called Ingenuity (Incubator Manager 1). It should be noted that the hub also received substantial financial support from the federal government.

Alberta Programs

Table 3: Alberta Innovation Network Programs

ORGANIZATION	PROGRAMS
Alberta Heritage Foundation for Medical Research	<ul style="list-style-type: none"> • Technology Commercialization Program (1985-2011) • Technology Transfer Program (1985-2011)
Ministry of Advanced Education and Technology	<ul style="list-style-type: none"> • Informatics Circle of Research Excellence (1999-2009)
Alberta Heritage Foundation for Science and Engineering	<ul style="list-style-type: none"> • Alberta Ingenuity Fund (2000-2010) • Industry Associates Program (2000-2019, transferred to AITF)

Table 3: Alberta Innovation Network Programs

ORGANIZATION	PROGRAMS
Alberta Innovates—Technology Futures (AITF)	<ul style="list-style-type: none"> • Industry Associates Program (2000-2019, transferred to Alberta Innovates Inc.) • Applied Research Facilities (2010-Present, transferred to Alberta Innovates Inc.) <ul style="list-style-type: none"> • Edmonton Facility • Calgary Facility • Devon Facility • Vegreville Facility • Regional Innovation Networks (2010-Present, transferred to Alberta Innovates Inc.) <ul style="list-style-type: none"> • Calgary Innovation Coalition • Central Alberta Regional Innovation Network • Edmonton Regional Innovation Network (ERIN) • East Central Alberta Regional Innovation Network • Wood Buffalo Regional Innovation Network • Grande Prairie Regional Innovation Network • APEX: Southeast Alberta Regional Innovation Network • The Regional Innovation Network of Southern Alberta
Alberta Innovates—Bio Solutions (AI Bio)	<ul style="list-style-type: none"> • Alberta Prion Research Institute (2010-Present, transferred to Alberta Innovates Inc.) <ul style="list-style-type: none"> • Innovation and Delivery Program • New Collaborations Program • Biorefining Conversions Network (2010-Present, transferred to Alberta Innovates Inc.)
Alberta Innovates Inc.	<ul style="list-style-type: none"> • Industry Associates Program (2000-2019) • Applied Research Facilities (2010-Present) • Regional Innovation Networks (2010-Present) • Alberta Prion Research Institute (2010-Present) • Biorefining Conversions Network (2010-Present) • Alberta-Ontario Innovation Program (2014-2018) • Innovation Voucher Program (2016-Present) • R&D Associates Program (2016-Present) • Accelerating Innovations Into Care Program (2016-Present) • Alberta Entrepreneurship Incubator Program (2017-2019) • Alberta Small Business Innovation and Research Initiative (2018-Present) • Inventures (2018-Present) • Campus Alberta Small Business Engagement Program (2019-Present) • Alberta Scaleup and Growth Accelerators Program (2020-Present)

The 1970s was a decade of tremendous economic growth and prosperity for Alberta, as rising oil prices allowed the province’s oil producers to reap massive profits. Peter Lougheed, the

premier of Alberta throughout the decade, increased the royalties imposed on oil producers, and created a state-owned oil company called the Alberta Energy Company (McQuaig, 2019, p176). Both of these measures allowed the provincial government to benefit financially from the unprecedented oil bounty in the province. As oil revenues poured into its coffers, the provincial government began investing in projects that would diversify Alberta's economy (Chambers, Brisbois & Emter, 2014, p108). One of these projects involved the creation of the Alberta Heritage Foundation for Medical Research (AHFMR). Launched in 1980 with an initial endowment of \$300 million, this foundation provided grants and awards to medical researchers across the province (Ministry of Advanced Education and Technology, 2007, p9). During its early years of operation, AHFMR introduced the Technology Transfer Program, which helped private medical companies exploit and commercialize the results of medical research (Government of Canada, 1993, p17). Throughout the 1990s, AHFMR continued to sponsor medical researchers and foster public-private collaboration. In 1999, the provincial government established iCORE Inc., a nonprofit organization dedicated to attracting promising researchers and graduate students to Alberta. The organization primarily targeted individuals specializing in information and communication technology (ICT). It often worked closely with private ICT companies, co-funding grants and scholarships with them (Sa, 2010, p349).

Alberta's innovation ecosystem changed dramatically in 2010, when the provincial government established four innovation-oriented crown corporations: Alberta Innovates—Bio Solutions (AI Bio), Alberta Innovates—Technology Futures (AITF), Alberta Innovates—Energy and Environment Solutions (AIEE), and Alberta Innovates—Health Solutions (AIHS) (Ministry of Advanced Education and Technology, 2011, p15). These corporations supported innovative businesses, stimulated academic research in different scientific fields, and created connections

between the academic and industrial sectors. Each corporation focussed on a particular industrial sector. AI Bio, for instance, focussed on the forestry and agricultural sector, while AIHS focussed on the health and biomedical sector. One of the most notable initiatives carried out by AI Bio was the creation of the Biorefining Conversions Network, a virtual innovation network based in the University of Alberta. This network brought together researchers from the academic and nonprofit sectors to develop consumer products derived from plant materials (Alberta Innovates – Bio Solutions, 2014, p8). AI Bio also funded the Alberta Prion Research Institute (APRI), a public research institution that sought to prevent the spread of prion-based diseases among humans and animals. Through its Innovation and Delivery Program, APRI fostered collaboration between academic researchers and private companies in the animal breeding industry.

Of all the Alberta Innovates corporations, AITF was perhaps the most committed to creating and supporting innovation networks. During its first few years in operation, the corporation built a number of physical innovation spaces, including four research laboratories, three experimental greenhouses, and one research farm (Alberta Innovates Technology Futures, 2016, p23-24). Together, these spaces occupy one million square feet of real estate, and employ hundreds of researchers, technicians, and support staff. Private companies in Alberta can use these spaces to develop and test new products with the help of experts. AITF also fostered dialogue between universities, colleges, technology incubators, and local economic development corporations in different regions across Alberta (Program Officer 8). As these organizations engaged in discussions under the aegis of AITF, they discovered ways to better support each other and coordinate their activities. In some regions, these organizations formed Regional Innovation Networks (RINs), virtual networks dedicated to supporting Alberta-based entrepreneurs (Alberta Innovates, 2019, p17). There are currently eight RINs throughout the

province, two of which are based in urban regions (the Edmonton and Calgary areas), and six of which are based in rural regions (the Grand Prairie area, Wood Buffalo, Central Alberta, East Central Alberta, Southern Alberta, and Southeast Alberta). The rural RINs have approximately 25 member organizations, while the urban ones have approximately 100.

In order to understand how the RINs function, we will briefly examine the structure and governance of one particular RIN: the Edmonton Regional Innovation Network (ERIN). ERIN currently has 89 member organizations, including post-secondary institutions, technology incubators/accelerators, local economic development corporations, and private business consultancies. One of the member organizations, Business Link, serves as the ‘banker’ for the network. Every year, Business Link receives money from AITF (now Alberta Innovates Inc.), and then distributes this money to other member organizations. Members use this money to provide services to entrepreneurs for free or at low cost (Program Officer 10). For example, Innovate Edmonton, one of the most prominent member organizations, assists Edmonton-based entrepreneurs with business planning, customer discovery, and marketing. It also operates a small incubator space in downtown Edmonton called Startup Edmonton. Member organizations often strategize with each other, harmonize their programs and services, and carry out programs and events jointly. They only use Business Link/Alberta Innovates funding to pay for the delivery of services, not for capital expenses (building construction, research equipment) or operational expenses (building maintenance, utilities, overhead). This was clearly explained by an Alberta Innovates representative interviewed for this research study:

“If a member organization is building a makerspace, it can buy a 3D printer with our dollars, that’s okay. But we’re not going to help it buy research equipment, that’s not what we’re set up to do. We don’t do large capital investments. We don’t help members buy furniture. If an economic development authority is setting up an incubator or accelerator, and it needs to revamp or remodel a building, we don’t pay for construction costs, we don’t

pay for chairs. Sometimes there is the odd computer that we pay for. But we're not paying the water and gas bills of member organizations" (Program Officer 8).

In 2016, the government of Alberta became aware of organizational problems and inefficiencies among the four Alberta Innovates corporations. An expert review revealed that the corporations had unclear organizational boundaries, resulting in wasted money and resources (Program Officer 8). To rectify the situation, the government decided to consolidate the corporations into a single entity called Alberta Innovates Inc. (Alberta Innovates, 2018, p7). It was hoped that this new entity would deliver innovation programs in a more streamlined way, minimize program duplication, and cultivate even deeper connections between industry and academia. Soon after its creation, Alberta Innovates Inc. assumed responsibility for managing the RINs and all existing innovation programs. It also launched a number of new programs, including the R&D Associates Program, which gives small technology companies money to hire academic researchers for one year (Alberta Innovates, 2020). In an attempt to strengthen Alberta's innovation ecosystem and make it more cohesive, Alberta Innovates Inc. began hosting an annual event called Inventures. This three-day event brings together over 2,000 entrepreneurs, venture capitalists, researchers, and other innovation stakeholders throughout Alberta, creating opportunities for networking and knowledge exchange. During the event, stakeholders participate in discussion panels, lectures and presentations, and product demonstrations and pitches (Alberta Innovates, 2019, p31).

Alberta Innovates Inc. provides core funding to a number of communal research laboratories, including the Alberta Carbon Conversion Technology Centre (ACCTC), the Alberta Machine Intelligence Institute (AMII), nanoFAB, and the Alberta Centre for Advanced MNT Products (ACAMP). Each laboratory employs highly-skilled researchers who assist

entrepreneurs with the design, testing, prototyping, and application of new technologies. ACCTC is located beside a natural gas power plant in Calgary, allowing its researchers to access highly-concentrated carbon dioxide for R&D. Working directly with entrepreneurs, these researchers develop new technologies that capture carbon dioxide and transform it into “commercially viable, value-added products” (InnoTech Alberta, 2018). AMII conducts research into artificial intelligence (AI), and teaches entrepreneurs how to use AI to enhance the performance of their businesses. nanoFAB is a 25,000 square foot facility that contains sophisticated sensor and fabricator instruments, such as scanning electron microscopes, electron beam evaporators, spectrophotometers, high-resolution 3D printers, and micro-manipulators. These tools allow researchers and entrepreneurs to analyze and fabricate materials on a microscopic scale (Alberta Innovates, 2019, p21). Finally, ACAMP manages two manufacturing facilities where entrepreneurs can refine their products using advanced metering, testing, and assembly equipment. According to an interviewee from ACAMP (Incubator Manager 3), these two facilities also provide office space or incubation space to entrepreneurs. It is also worth mentioning the Life Sciences Innovation Hub, a communal laboratory and incubator situated on the campus of the University of Calgary. Unlike the other laboratories just discussed, the Life Sciences Innovation Hub does not receive core or operational funding from Alberta Innovates, but only receives program funding. The Hub contains 140,000 square feet of space, and houses 70 small and medium-sized life sciences companies (Director 8).

Conclusion

For over 30 years, the federal government, Ontario government, and Alberta government have sought to create and strengthen innovation networks in an attempt to stimulate economic growth and diversification. Through a vast array of programs, these governments have forged

linkages between entrepreneurs/firms, investors, colleges/universities, and nonprofit research institutions within their jurisdictions. The aim of this chapter was to systematically catalogue these programs, a task that no Canadian scholar has undertaken (at least on this scale). Drawing upon both archival materials (documents) and interviews, the chapter identified almost every network program that was carried out from the 1980s to the present day. It also described many of these programs, providing a general account of their structures, operations, and administrative features. The chapter did not compare federal and provincial programs, however, nor did it place these programs within a geopolitical context. The ultimate goal of this research project, it will be recalled, is to determine whether the federal and provincial governments have different approaches to promoting innovation networks, and to better understand how network programs are shaped by geopolitical forces. These questions are fully explored in the next chapter.

Chapter 7: A Comparison of Federal and Provincial Network Programs

The purpose of this chapter is to compare innovation network policies/programs at the federal and provincial levels, drawing upon both interviews and government documents. These policies/programs will be compared from two different perspectives. First, we will consider whether they create, fund, and support different *types* of innovation network (virtual and anchored networks). In previous chapters, it was hypothesized that the federal government focuses on virtual networks, while provincial governments focus on anchored networks (brick-and-mortar innovation spaces). Second, we will consider whether federal and provincial policies/programs target different industries or areas of technology, such as agriculture, health, transportation, and advanced manufacturing. As we explore these questions, it will become evident that innovation network policies are shaped and influenced by both geopolitical factors and historical/institutional factors.

Differences in Network Type

In the previous chapter, we identified and described almost every innovation network program carried out by the federal government since the 1980s. Having conducted this sweeping survey of federal programs, it is evident that the federal government creates and supports both virtual innovation networks *and* anchored innovation networks. Virtual networks have been created through programs such as the Networks of Centres of Excellence Program, Applied Research and Development Grants, Atlantic Innovation Fund, and Innovation Supercluster Initiative. Anchored networks, on the other hand, have been created and supported through various programs delivered by the Canada Foundation for Innovation (CFI), National Research Council (NRC), Natural Sciences and Engineering Research Council (NSERC), and regional development agencies (FedDev, Atlantic Canada Opportunities Agency, Western Economic

Diversification). Some federal agencies have created/promoted both virtual and anchored networks simultaneously. For example, NSERC has brought private enterprises, universities, and colleges together virtually through its Engage Grants, Applied Research and Development Grants, and other grant programs, while at the same time co-funding communal laboratories called Technology Access Centres across Canada (Natural Science and Engineering Research Council, 2022a; Program Officer 1). In 2016, FedDev helped create the Southern Ontario Network for Advanced Manufacturing Innovation (SONAMI), a completely virtual innovation network made up of nine post-secondary institutions (Southern Ontario Network for Advanced Manufacturing Innovation, 2022). The same year, it gave money to various technology incubators and accelerators in southern Ontario to support their new women-focussed entrepreneurship programs (Federal Economic Development Agency for Southern Ontario, 2018; Incubator Manager 5).

Like the federal government, the provincial government of Ontario has supported both virtual and anchored innovation networks since the mid-1980s. On the virtual side, the Ontario government launched the Ontario Centres of Excellence Program, Sector Partnership Fund, Collaboration Voucher Program, and Invest North Program, all of which encourage and enable collaboration between innovative actors and organizations that are not physically co-located or geographically proximate (Bell, 1996; Ontario Centres of Excellence, 2013, p23; Northern Ontario Heritage Fund Corporation, 2022a). On the anchored side, the government helped create a number of facilities throughout Ontario where entrepreneurs can access advanced equipment and technology, meet with professional mentors, and network with other actors in Ontario's innovation ecosystem (students, academics, intellectual property specialists, other entrepreneurs). These facilities are not homogeneous or uniform, but rather vary significantly in their size,

clientele, financial resources, and technological capabilities. They have many different names, including Regional Innovation Centres, Campus-Linked Accelerators, and Regional Technology Development Sites (Ontario Centres of Excellence, 2017, p16; Ontario Centres of Excellence, 2018, p5). In Alberta, both virtual and anchored innovation networks have been cultivated by Alberta Innovates, a nonprofit organization that is very closely tied to the provincial government. Since it was founded in 2010, Alberta Innovates has built and funded many communal research laboratories where entrepreneurs and academic researchers can work together on the development of new products and technologies (Alberta Innovates Technology Futures, 2016; InnoTech Alberta, 2018; Alberta Innovates, 2019, p21). The organization has also encouraged universities, colleges, technology incubators, and local economic development corporations that are clustered in the same region to form Regional Innovation Networks, virtual networks that assist local entrepreneurs in different ways (Alberta Innovates, 2019, p17; Program Officer 8).

During the data collection phase of this research project, interviewees were asked to describe the federal government's general approach to creating innovation networks. Eight interviewees stated that the federal government tends to create virtual innovation networks, often in the form of large multi-disciplinary research teams and industry-academic research consortia. They also stated that the federal government is somewhat reluctant to build physical innovation spaces, such as innovation hubs, technology incubators, and science parks (Program Officer 2; Program Officer 4; Program Officer 6; Policy Analyst 1; Manager 4; Incubator Manager 3; Director 2; Administrator 1). When asked *why* the federal government takes a virtual approach, these interviewees offered three different reasons. First, the federal government lacks the resources needed to build technology incubators, innovation hubs, and other physical innovation spaces in every province and region of Canada. It would need to be selective, therefore, when

deciding where to build these spaces. Inevitably, some provinces and regions would be left out, leading to inter-regional and inter-provincial conflict. In addition, there would likely be severe backlash against the federal government in those regions that are left out or denied federal investment:

“I really think that, in order to appear as though it is serving all of its constituents, the federal government can’t invest too much money in one location or another location. The federal government needs to make its services and its big investments accessible to more than just one place (or just a handful of places). If the federal government just builds three or four innovation hubs, what would Saskatchewan do? What would PEI say? It’s gonna be an issue. It can’t just build one in Montreal, one in Toronto, one in Vancouver, and one in Calgary. It can’t do that. There are too many other places that need to have coverage of some form. I think that’s why the federal government prefers virtual networks” (Manager 4).

The second reason why the federal government prefers virtual networks, according to these interviewees, is that such networks are often very large in scale. As we will see later, many virtual networks in Canada span multiple provinces and regions, with some even encompassing all of Canada. By creating such geographically vast networks, the federal government can bring together expertise across the country, thereby advancing national scientific and industrial objectives. It can also ensure that *all* provinces and regions of Canada are able to participate in—and benefit from—technological development and innovation:

“In my view, a virtual network allows expertise across the country to be brought together. It allows pockets of expertise that may not be concentrated in one single geographical region to still become part of this overall network, and reap the benefits of being a part of that network. In that sense, it very much fulfills the mandate of the federal government. It’s actually looking out for a national and federal interest, as opposed to something that’s purely regional” (Policy Analyst 1).

Third, virtual networks can be created everywhere in Canada, as they are relatively easy to set up and do not require major investments in infrastructure. As a result, they allow academics, entrepreneurs, and other highly-skilled people to participate in groundbreaking innovative projects no matter where they live in the country. According to one interviewee (Program Officer

4), it is very important to the federal government that highly-skilled people in all parts of Canada enjoy opportunities for professional development and career advancement.

The interviewees discussed above not only believed that the federal government has a proclivity for virtual innovation networks, but also that provincial governments are more willing to create physical, brick-and-mortar innovation spaces than the federal government. Two explanations were given for this. First, provincial governments are constitutionally responsible for funding and overseeing post-secondary institutions, many of which recognize the importance of business/technology incubation and knowledge commercialization. To support incubation and commercialization activities, many of these institutions have built facilities where students can start their own business ventures, academics can commercialize their research, and local innovators can learn about new technologies (Program Officer 2; Incubator Manager 3). Second, provincial governments have very close relationships with municipal governments, local chambers of commerce, and local economic development corporations. Most of these local entities are interested in building modern infrastructure within their jurisdictions, including science parks, technology incubators, and innovation hubs. Since local entities have limited resources, they frequently call upon provincial governments to finance the construction of such infrastructure:

“I think the provincial governments are more likely to invest in those physical spaces because they of course have a very close working relationship with the municipalities, and it’s often the municipalities that drive the need or the request to establish those physical innovation centres. And of course, the first partner they [the municipalities] go to is the provincial government, who recognizes that basically the province is made up of municipalities, and if the municipalities are strong and innovative, they do well... Big cities are big drivers of economic activity, and these big cities are very much interested in infrastructure. If you’re looking at Calgary, the city is looking to find new purposes for all the empty buildings downtown, for instance. So they’re mainly interested in investing in the renovation of existing infrastructure to make it usable for new businesses, entrepreneurs, and others. So I think the provincial governments are much more closely connected to municipal economic development entities than the federal government is, and

the municipal economic development entities see a lot of value in physical infrastructure. For that reason, they [the provincial governments] are more interested than the federal government in that physical infrastructure” (Director 2).

The above statement from Director 2, it should be noted, perfectly accords with one of the theories presented in Chapter 4—namely, that provincial governments invest heavily in physical innovation spaces because they are pressured to do so by municipal governments and other local entities.

While many interviewees agreed with the hypotheses laid out in chapters 1 and 4, some expressed skepticism towards them and directly challenged them. Of the 41 individuals interviewed, 10 of them rejected the idea that provincial governments are more willing to create and fund physical innovation spaces (anchored networks) than the federal government. For example, one suggested that federal and provincial governments are equally committed to creating these spaces and to supporting them financially through grants and subsidies (Director 5). Both federal and provincial politicians, he argued, want these spaces to be built because they generate political support and good will among constituents. Whenever new innovation spaces are established, they provide ‘photo opportunities’ to prime ministers, federal cabinet ministers, provincial premiers, members of provincial parliaments, and other elected officials at the federal and provincial levels. Another interviewee suggested that, since the announcement of its ‘innovation strategy’ in 1992, the federal government has assumed primary responsibility for creating physical innovation spaces in Canada (Director 6). One of the most interesting observations was made by a federal program officer (Program Officer 3), who said that both federal and provincial governments fund innovation spaces, but only provincial governments *initiate the creation of these spaces*:

“Most innovation spaces that I’ve seen are joint federal-provincial investments. I think it’s rare for a province to invest in one without the feds contributing something. So the

provinces might champion the need for some infrastructure, but they won't put a shovel in the ground until they know the feds are going to match or contribute in some way. So there's an interdependence there. I would say the initiative comes from the provinces, but their willingness to invest is contingent on federal co-funding the majority of the time. Not always, there's always exceptions. That's been my experience" (Program Officer 3).

Upon reflection, the above statement seems perfectly logical. As we saw in Chapter 4, innovation spaces or 'technopoles' are very expensive to create, since they must include offices, laboratories, information technology systems, advanced equipment, and professional staffs. It is unlikely that provincial governments, even those with large tax bases, can afford to create these spaces without some federal support. At the same time, the federal government may not contribute financially to these spaces unless it faces pressure or lobbying from provincial (and municipal) actors.

There is considerable empirical evidence that federal and provincial governments co-fund physical innovation spaces, as suggested above. Almost every technology incubator, business accelerator, and innovation hub in Ontario and Alberta has received both federal and provincial funding at some point in time. One of Ontario's most famous research laboratories and anchored innovation networks, the Perimeter Institute for Theoretical Physics, currently receives equal amounts of funding from both levels of government (Perimeter Institute for Theoretical Physics, 2021). The same is true of the Life Sciences Innovation Hub, a large facility in Calgary that houses 70 small and medium-sized life sciences companies (Director 8). All of Ontario's Regional Innovation Centres get both federal and provincial money, but in unequal proportions; some of them get more federal than provincial money, and vice versa (Incubator Manager 5; Incubator Manager 6). Some innovation spaces received provincial funding during their early years of operation, but later turned to the federal government for funding as circumstances changed. For example, one technology incubator in Thunder Bay was initially funded by the

provincial government of Ontario through OCE Inc., but is currently funded by the federal government through FedNor (Incubator Manager 1). Another incubator in Hamilton received provincial funding until 2018, when OCE Inc. cancelled the Campus-Linked Accelerator Program. To continue to cover its operational expenses, the incubator established an annual funding agreement with its host university. Soon after this, it secured a \$2 million grant from FedDev (a federal agency), using the money to refurbish and expand the building where it is located. The building now contains more meeting rooms, an enlarged co-working space, and a makerspace equipped with 3D printers, laser cutters, and other tools that entrepreneurs can use freely (Incubator Manager 4).

While federal and provincial governments both give money to technology incubators, innovation hubs, and other physical innovation spaces, this money is often used for different purposes. Provincial money is often used to cover *operational* expenses—that is, expenses incurred through routine or regular operations and activities. These expenses include staff salaries, building utilities, insurance, accounting services, and property taxes. Federal money, on the other hand, is generally used to cover *capital* expenses—that is, expenses associated with organizational change, growth, and development. These expenses include the acquisition of new equipment, the expansion of facilities, and the delivery of new programs to clients and tenants. Almost every interviewee who manages a technology incubator testified to the different (but complementary) funding roles played by the federal and provincial governments. They explained how provincial funding allows their incubators to pay for overhead (salaries, utilities), while federal funding allows them to undertake new investments and projects (Incubator Manager 1; Incubator Manager 2; Incubator Manager 3; Incubator Manager 4; Incubator Manager 5; Incubator Manager 6). Since federal funding is tied to specific projects, like the delivery of new

programs, it is usually temporary and short-term. Once projects are completed, the federal government closes the ‘funding tap’. This was made clear by one interviewee, Incubator Manager 6, who manages a Regional Innovation Centre in Ontario: “All the funding we get from the federal government is project-specific funding. Basically, we get federal dollars to do specific things. Once those [things are done], the funding ends” (Incubator Manager 6). Of course, some physical innovation spaces not only receive temporary project funding from the federal government, but also regular operational funding. The National Research Council’s communal laboratories come to mind here.

Before proceeding to the next section, it is important to explore why federal and provincial governments have different funding relationships with physical innovation spaces. Why does the federal government provide these spaces with capital funding, while provincial governments provide them with operational funding? One explanation is that these governments are subject to different geopolitical forces, or operate under different geopolitical conditions, limitations, and logics. As we saw in Chapter 4, the federal government is deeply committed to promoting regional economic balance and equality throughout Canada. It is important to federal policymakers that every province and region of the country is able to advance economically, or at least maintain a relatively high level of economic performance. The federal government feels compelled, therefore, to fund physical innovation spaces in *all* parts of Canada, from industrial and urban centres in Ontario and Quebec to rural hinterlands in Manitoba and Newfoundland. Of course, due to fiscal constraints, it cannot provide operational funding to hundreds of innovation spaces across the country. It can, however, provide these spaces with grants for short-term projects. These projects may include the delivery of new programs to clients, the acquisition of new equipment, or the hosting of new workshops, conferences, and other events. According to

both interviewees and government documents, the federal government often funds these projects through arms-length agencies, such as the Federal Economic Development Agency for Southern Ontario, the Natural Sciences and Engineering Research Council, and the Canadian Foundation for Innovation. Unlike the federal government, provincial governments are able to provide operational funding to innovation spaces, because they have much fewer of these spaces within their jurisdictions.

Differences in Industry/Technology Focus

Up to this point, we have explored whether federal and provincial governments support different types of innovation network (virtual and anchored). Based on the evidence examined so far, we can confidently say that both levels of government create and fund virtual networks. We can also say that federal and provincial governments share the cost of establishing, maintaining, and expanding anchored innovation networks (technology incubators, innovation hubs, etc). There is a possibility, however, that provincial governments and their municipal partners *initiate the creation of anchored networks*. One question that has not been explored is whether federal and provincial governments target different industries or areas of technology through their innovation network policies/programs. During the data collection process, it was discovered that federal and provincial governments do, in fact, have different industrial and technological focuses. Moreover, these governments prioritize different industries and technologies because they have different industrial policy histories—in other words, they have pursued different industrial policy strategies and initiatives in the past. This finding is consistent with the new institutionalist theory of ‘path dependency’, which suggests that public policies today are influenced or informed in some way by public policies from earlier historical periods or eras.

As we saw in Chapter 5, the federal government became very interested in promoting scientific research in the early twentieth century. In 1917, it established the National Research Council (NRC), an organization dedicated to funding and coordinating important scientific research projects (Eggleston, 1978, p1-10). Soon after its creation, the NRC began funding agricultural projects aimed at developing new wheat cultivars, preventing the spread of diseases among farm animals, and improving the quality of Canada's agricultural products (Estey, 1992). During the second world war, the NRC broadened its mandate to include medical research. Through its Committee on Medical Research, the organization funded projects on war-related illnesses and diseases, such as decompression sickness, tuberculosis, and traumatic injury (Romano, 1992). Over the next few decades, the NRC continued to invest in both agricultural and medical research, including research into plant protoplasts, plant diseases, and hormone therapies for arthritis and other diseases (Li, 1992, p101). Throughout this period, other federal agencies and organizations—namely, the Department of Agriculture, the Medical Research Council, and the Natural Sciences and Engineering Research Council—also invested heavily in these two areas of research. The point here is that the federal government has a very long history of funding and supporting agricultural and medical research. It should not be surprising, therefore, that many of the innovation networks sponsored by the federal government since the mid-1980s have focused on agriculture and health.

The first major innovation network program carried out by the federal government, the Networks of Centres of Excellence (NCE) program, sponsored fifteen innovation networks during its first year of operation (Government of Canada, 1989). About half of these networks focused on agriculture, health, or both. One network, the Pest Management Network, sought to develop environmentally-friendly methods for eliminating plant-killing insects, such as mountain

pine beetles and emerald ash borers. Another network, the Genetic Diseases Network, sought to understand how certain genetic mutations in humans cause diseases, such as down syndrome and cystic fibrosis. It also sought to find more effective and efficient ways to diagnose and treat genetic diseases. Two networks, the Bacterial Diseases Network and the Protein Engineering Network, conducted research that was relevant to both the agricultural and health sectors. In the year 2000, the federal government established two new innovation-focused agencies: Genome Canada and the Canadian Institutes of Health Research (CIHR). Genome Canada funds innovation networks that use genetic information to solve practical problems, many of which relate to agriculture and health (Genome Canada, 2011, p4-20; Program Officer 3; Director 2). CIHR, meanwhile, funds networks that investigate complex health-related issues, including brain health, addiction, aging, and health services (Canadian Institutes of Health Research, 2004).

Like the federal government, the provincial government of Alberta has invested heavily in agricultural research since the early 1920s. In 1921, the provincial government established the Alberta Research Council (ARC), the first provincial research organization in Canada. For many decades, the ARC conducted soil surveys, created maps of Alberta's agricultural and geological terrain, tested animal vaccines, developed new forest management techniques, and carried out many other agricultural research projects (Howell, 1998; Wilson, 2002; Jaremko, 2004). The ARC was the most prominent public research organization in Alberta until 2010, when the provincial government created Alberta Innovates. Following in the footsteps of the ARC, Alberta Innovates funds and oversees many research projects related to plant cultivation, animal husbandry, and biomass conversion and utilization. Some projects seek to improve the quality of Alberta-grown vegetables and Alberta-raised meat, while others seek to develop new plant-based fuels, building materials, and nutritional supplements (Alberta Innovates Bio Solutions, 2014,

p13-35; Alberta Innovates Technology Futures, 2016, p33; Alberta Innovates, 2019, p26).

Virtually all of these projects are carried out by innovation networks made up of entrepreneurs, academic researchers, and government scientists.

According to its annual reports and program documents, Alberta Innovates not only supports research in the area of farming and agriculture, but also in the area of oil and natural gas extraction. Since its creation in 2010, the organization has funded research projects that deal with oil pipeline corrosion, oil spill detection, microbe-based oil recovery, oil asset monitoring, and bitumen transport (Alberta Innovates, 2019, p14-25). Like the agricultural projects mentioned earlier, these oil-focused projects are carried out by innovation networks or collaborative research teams. Some of them are carried out by large-scale research consortia, like the Materials and Reliability in Oil Sands (MARIOS) consortium, which consists of 40 private companies across Alberta (InnoTech Alberta, 2023). By investing in these oil-centric projects/networks, Alberta Innovates is continuing a very long industrial policy tradition in Alberta. Since the 1950s, let us recall, the provincial government of Alberta has actively supported the oil industry by providing oil companies with land, information, technology, and a favourable regulatory environment (see Chapter 5). In 1974, the government created the Alberta Oil Sands Technology and Research Authority (AOSTRA), which developed the first reliable method for extracting bitumen from the oil sands. Alberta Innovates is arguably building upon the legacy of these earlier industrial policies. This was actually made explicit by Alberta Innovates in one of its annual reports:

“It is well known that one of our predecessor organizations, the Alberta Oil Sands Technology and Research Authority (AOSTRA), developed the steam-assisted gravity drainage (SAGD) technology to extract bitumen from the oil sands, which led to a multibillion-dollar industry in Alberta. Now, Alberta Innovates is helping improve the economic and greenhouse gas competitiveness of the oil sands industry through the

development of the next wave of in-situ recovery technologies, including solvent-enhanced or solvent-based recovery technologies” (Alberta Innovates, 2019, p14).

Between 1993 and 2006, the federal government was committed to reducing Canada’s greenhouse gas emissions and combatting global warming. As we saw in Chapter 5, the government signed Canada onto the Kyoto Protocol, an international treaty on greenhouse gas reduction. It then carried out a number of policies designed to reduce Canada’s reliance on fossil fuels (oil, natural gas) by increasing its use of renewable energy sources, such as solar, wind, and nuclear power (Brownsey, 2007, p152). When the Conservative Party came to power in 2006, the government withdrew Canada from the Kyoto Protocol, discontinued many of its green energy policies, and pledged to support the growth of the oil and gas industry. Since the return of the Liberal Party in 2015, however, the government has renewed its commitment to ‘de-carbonization’ and a ‘green energy transition’ (MacNeil & Paterson, 2018, p379-380). Under these circumstances, the federal government is not willing to fund innovation networks in the area of oil and gas, because this would clearly conflict with its de-carbonization agenda. The provincial government of Alberta, in contrast, is willing to invest in such networks. One interviewee, Director 2, commented on this situation:

“It would not be wise politically for the federal government to support innovation networks in the oil and gas sector, because it wants Canada to move away from fossil fuels. The Alberta government, on the other hand, continues to make the case that innovation in oil and gas exploration and development is necessary. It continues to argue that hydrocarbon resources will be used for the next couple of decades, and that we should extract those resources... This is a case where, for the federal government, it would be very difficult for them to be seen as supporting innovation in a resource sector area that they have declared that they want to move away from. Whereas for provinces like Alberta, they see that [energy transition] as well, but they see the transition happening at a much slower pace, and they feel that they want to continue to invest in those areas” (Director 2).

In the 1980s and early-1990s, the provincial government of Ontario began funding innovation networks through the Ontario Centres of Excellence (OCE) program, Sector Partnership Fund, and other programs. Many provincially-funded networks focused on traditional manufacturing activities, such as food processing, dye and chemical production, and automobile and auto parts production (Wolfe & Gertler, 2001, p585-586). The goal of these networks was to improve manufacturing methods and processes through the application of new technologies, including microprocessors and computer software. One network, which was established in 1995 through the OCE program, developed “a methodology and software tool to [help manufacturers] evaluate the economic consequences of mechanical failures and preventative maintenance” (Ontario Centres of Excellence, 2004, p15). The provincial government continues to fund manufacturing-based innovation networks today. In fact, one of the largest innovation networks in Ontario is the Ontario Vehicle Innovation Network (OVIN), which seeks to develop autonomous, electric, and low-carbon vehicles that can be manufactured in Ontario (Ontario Centres of Excellence, 2020; Manager 1). This network brings together automobile companies, small technology companies, post-secondary institutions, transit agencies, and other organizations across Ontario.

To understand why the provincial government of Ontario funds many innovation networks related to manufacturing, we must consider Ontario’s industrial policy history, which was discussed in-depth in Chapter 5. In the late nineteenth century, the provincial government realized that Ontario’s physical geography was unsuitable for farming and agriculture, but ideal for heavy manufacturing. Upon this realization, it began supporting a number of manufacturing industries—metal refining, pulp and paper, chemicals—by providing subsidies, technical training, and cheap electric power (Nelles, 2005). Between 1910 and 1950, Ontario’s

manufacturing sector grew rapidly, driven largely by foreign direct investment from the United States (Smardon, 2014, p77-98). In the 1960s and 1970s, the provincial government launched many new industrial initiatives, most of which targeted manufacturing (Bird, 1985, p56-59). It created the Ontario Development Corporation, a crown corporation that provided loans and loan guarantees to small and medium-sized manufacturing enterprises. After this, it allowed manufacturing enterprises to purchase equipment and machinery without paying sales taxes. It also encouraged foreign automobile companies to set up new branch plants in Ontario by providing financial incentives. In the 1980s and 1990s, Ontario's manufacturing sector lost its competitive advantage due to globalization, free trade, and rapid technological change (Bradford, 2003, p1008). Many manufacturing enterprises at the time considered leaving the province. The provincial government refused to let this sector die, because it had invested so much energy, money, and political capital to support its development. In order to help this sector overcome its current structural challenges, the government created and funded manufacturing-based innovation networks.

Conclusion

This chapter provided a comparison of federal and provincial approaches to creating, funding, and supporting innovation networks. It first considered whether federal and provincial governments focus on different *types* of innovation network (virtual and anchored). Based on the evidence gathered, it is clear that the federal government focuses equally on virtual and anchored networks. This is also the case with provincial governments, which do not prefer to support one network type over another. This finding contradicts one of the hypotheses presented in chapters 1 and 4—namely, that the federal government primarily focuses on virtual networks while provincial governments focus on anchored networks. One interesting observation is that federal

and provincial governments provide anchored networks with different kinds of funding. The federal government generally provides these networks with *capital* funding—that is, funding directed towards organizational change, expansion, and development. This funding is usually temporary or short-term. Provincial governments, on the other hand, provide these networks with *operational* funding—that is, funding directed towards regular or routine activities. This funding is usually ongoing or long-term. It is likely that federal and provincial governments have different funding relationships with anchored networks because they operate under different geopolitical conditions and logics.

After exploring whether federal and provincial governments focus on different network types, the chapter shifted its attention toward another comparative question: do federal and provincial governments target different industries or areas of technology through their innovation network policies and programs? It found that these governments do, in fact, have different industrial and technological specializations. The federal government specializes in agriculture and health, the provincial government of Alberta specializes in agriculture and energy (especially oil and gas), and the provincial government of Ontario specializes in manufacturing. The chapter argued that these differences in industrial/technological focus can largely be explained by historical factors. Put simply, these governments target different industries and technologies because they have pursued different industrial policies in the past. This argument is rooted in new institutionalist thinking, especially in the theory of ‘path dependency’.

Chapter 8: Discussion and Analysis of Research Findings

This concluding chapter seeks to present, discuss, and analyze the main findings of this research project, as well as suggest future directions for research. The chapter is divided into six sections. The first section summarizes the research findings with respect to federal and provincial innovation network programs, strategies, and initiatives. The next three sections highlight and elucidate certain findings that have not yet been addressed. These findings relate to the geographical distribution and coverage of federal-level innovation networks, the ability of anchored innovation networks to brand or market cities, the role of local-level actors in the creation of anchored networks, and the impact of intergovernmental relations on anchored network funding. The fifth section presents three empirically-grounded theories that emerged out of this research project, and proposes ways in which these theories can be tested. It also presents new research questions that warrant scholarly investigation. The sixth section concludes the dissertation.

Summary of Research Findings

The methodological appendix at the end of this dissertation distinguishes between different kinds of social science research. In particular, it distinguishes between *deductive* research, which aims to test hypotheses and theories through rigorous and tightly-controlled experimentation and analysis, and *inductive* research, which aims to generate new theories through flexible and open-ended data collection. This dissertation followed an inductive mode of inquiry. Its main goal was to determine whether federal and provincial innovation network policies are different from each other and, if so, how they are different. Even more importantly, it sought to develop theories as to *why* these policies are different (or not different), paying

particular attention to geopolitical and historical-institutional factors. Before any data was collected, a few working hypotheses were formulated (see Chapter 4). These working hypotheses were based on preliminary archival research, as well as academic writings on urbanization, inter-governmental relations, and technopoles. As the research process unfolded, some of these working hypotheses were developed into grounded theories. At the same time, some completely new theories were generated based on the information gathered from interviews and document analyses.

One of the working hypotheses formulated at the outset of this dissertation was that the federal government primarily supports *virtual* innovation networks, because these networks are effective instruments for promoting regional economic balance. Conversely, provincial governments primarily support *anchored* innovation networks, because these networks serve the interests of local economic and political elites, many of whom have close ties to provincial leaders. Throughout the research process, it became clear that this working hypothesis required modification and refinement. Federal and provincial governments, it was discovered, both support virtual and anchored networks equally. The federal government has supported virtual networks for decades through the Networks of Centres of Excellence Program, Innovation Supercluster Initiative, Genome Canada, and the Canadian Institutes of Health Research. At the same time, it has supported anchored networks through the Canadian Foundation for Innovation, National Research Council, Natural Sciences and Engineering Research Council, and the various regional development agencies. Similarly, the provincial governments of Ontario and Alberta have supported both virtual and anchored networks through the Ontario Ministry of Research and Innovation, Alberta Innovates, the Ontario Centres of Excellence, and the Northern Ontario Heritage Fund Corporation.

As data was collected through both interviews and document analysis, some highly unexpected observations were made. One observation was that, while federal and provincial governments both fund anchored innovation networks, they provide these networks with different kinds of funding. The federal government mostly provides them with *capital* funding, while provincial governments provide them with *operational* funding. This is because federal and provincial governments operate under different geopolitical conditions and logics. The federal government's steadfast commitment to promoting regional economic balance is certainly an important explanatory factor here, as shown in Chapter 7. Another interesting and unexpected observation was that the federal government, the provincial government of Ontario, and the provincial government of Alberta focus on different industries or areas of technology through their innovation network programs. The federal government focusses on agriculture and health, the Ontario government focusses on manufacturing, and the Alberta government focusses on agriculture and energy (oil and gas). This can be explained by the fact that these governments have different industrial policy histories—in other words, they have pursued different industrial policy strategies and initiatives in the past. It is important to note that, although these governments have different technological specializations, they also have some overlapping technological interests. For example, all three of them are interested in developing medical technology and biotechnology to some degree.

In Chapter 4, it was hypothesized that municipal governments, local chambers of commerce, and other local-level organizations pressure provincial governments to fund physical innovation spaces. Over the course of the research project, this working hypothesis was extended and deepened. According to the research data collected, local-level organizations do indeed lobby provincial governments to fund technology incubators, technology accelerators, science

parks, and innovation hubs. Contrary to previous assumptions, however, they also lobby the *federal government* for such funding. This was made clear by a number of interviewees who work for municipal governments and local economic development corporations in Ontario and Alberta. These interviewees explained how local-level organizations seek federal and provincial funding for innovation spaces through both formal channels (grant applications) and informal channels (meetings and discussions with federal and provincial officials). They also explained how some cities in Ontario and Alberta receive substantial federal and provincial funding to create and maintain physical innovation spaces, while others receive very little funding. Those that receive substantial funding usually have powerful municipal governments, expansive entrepreneurial and academic communities, large voter populations, and politically well-connected local organizations.

The Federal Approach: A Closer Look

In Chapter 4, it was argued that the federal government chooses to create virtual innovation networks for different geopolitical/geoeconomic reasons. One reason is that these networks can extend beyond provincial boundaries, allowing people in different provinces to exchange knowledge, technology, and other resources. According to both government documents and interviewees, many virtual networks created by the federal government since the late 1980s have encompassed multiple provinces, thus facilitating inter-provincial collaboration. For example, the Bacterial Diseases Network, which was created in 1989 through the federal NCE program, included researchers from Alberta, Quebec, British Columbia, Ontario, and Saskatchewan. These researchers worked together to study “bacterial attack and host response in very different biological systems (humans, animals, plants)” and to develop “vaccines, antibiotics, and diagnostic kits” (Government of Canada, 1989, p4). A more recent network,

Diabetes Action Canada, includes researchers and medical practitioners from Quebec, Manitoba, and New Brunswick. The purpose of this network is to “identify the health concerns of those living with diabetes and to co-create research projects that address these concerns” (Diabetes Action Canada, 2021). Both networks bring together professionals from economically advanced provinces (Ontario, Alberta, Quebec, British Columbia) and economically less developed provinces (Saskatchewan, Manitoba, New Brunswick).

Since it was established in 2001, Genome Canada has funded virtual innovation networks dedicated to genomics research—that is, the collection, study, and application of genetic information. As explained in Chapter 5, these networks not only seek to advance human knowledge about genetics, but also to solve practical and industrial problems using genetic science. Like the other virtual networks discussed above, these genomics-focused networks are made up of researchers and other highly-skilled professionals from many different provinces (Program Officer 2; Program Officer 3; Program Officer 6; Director 2). One of the most recent networks, for example, consists of genomics researchers, aquaculture experts, and industrial fish breeders from British Columbia, New Brunswick, Nova Scotia, and Newfoundland (Program Officer 3). Another newly-formed network, called SoyaGen, consists of plant scientists and agribusiness experts from Quebec, Ontario, and Saskatchewan (SoyaGen, 2023a; SoyaGen, 2023b). It should be noted that some of these networks not only receive funding from Genome Canada, but also from industrial partners, business associations, and universities.

In 2017, the federal government launched one of its most ambitious innovation network programs: the Innovation Supercluster Initiative (ISI). As we saw in Chapter 6, the ISI created five large innovation networks or ‘superclusters’ dedicated to developing and commercializing new products and technologies. Each supercluster contains hundreds of member organizations,

including small and large technology companies, post-secondary institutions, nonprofit research organizations, and technology incubators/accelerators. Although based in certain provinces and regions, the superclusters are national or pan-Canadian in scope, bringing together organizations from across Canada. One of the superclusters, the Protein Industries Supercluster, is based in the prairie region of Canada, but contains three-hundred member organizations from every province and region. All of the organizations within this supercluster contribute to the development, manufacturing, and marketing of plant-based foods. In an interview, an administrator of the Protein Industries Supercluster explained how the network “tears down provincial boundaries”:

“We have approximately three-hundred member organizations that span the geography of Canada, from BC to Atlantic Canada. These organizations also span what I would call the ‘value chain’, from plant breeding and ingredient processing to food retailing and distribution. Our aim is to create collaborations between these organizations...Plant-based food production in Canada happens on a national scale. Ingredient processing happens in the prairies, while food innovation and food manufacturing happens in BC, Ontario, and Quebec largely. So we are creating collaborations and bringing together organizations from across Canada. If you look at many of our projects, you’ll see that we’ve been able to tear down provincial boundaries” (Administrator 1).

The federal government recognizes that every province in Canada, even those with less developed economies, have innovation clusters that are capable of generating new technologies and driving economic growth. Each cluster specializes in a different area of technology, from information technology and nanotechnology to electric vehicles and advanced materials. Since the early 1990s, the federal government has tried to promote the growth of clusters throughout the country, as explained by Industry Canada in its 2001 report titled *Achieving Excellence*:

“The Government of Canada, including the National Research Council Canada, has played a key role in working with the private sector to stimulate the growth of clusters. Investments have been made in Nova Scotia (life sciences, information technologies), New Brunswick (e-commerce), and Newfoundland and Labrador (ocean technology). The 2001 budget announced further investments to encourage the development of clusters in Quebec (advanced aluminum technologies), Alberta (nanotechnology), Saskatchewan (crops for

advanced human health), and British Columbia (fuel cell technologies), as well as initiatives in Ontario and Manitoba” (Industry Canada, 2001a, p73).

One innovation cluster that has drawn considerable attention from the federal government is the ocean technology cluster in St. John’s, Newfoundland. Private companies, universities, and other organizations within this cluster develop technologies related to fishing, aquaculture, and offshore oil extraction (Doloreux & Shearmur, 2009, p524). For many years, the cluster received extensive financial, infrastructural, and logistical support from the National Research Council (NRC), allowing it to grow at a very fast rate:

“The NRC is playing many roles to help the St. John’s ocean technology cluster quadruple in size over the next 10 years. Its expertise and facilities enable the cluster’s 50 technology companies to develop and test new technologies for global markets—a critical contribution to achieving Government of Canada science and technology goals. The cluster has grown an average of 15 percent per year for the past five years. Behind much of that growth is NRC-supported collaboration involving businesses, governments, community-led boards and industry groups, and Memorial University of Newfoundland” (National Research Council Canada, 2008, p24).

By nurturing the ocean technology cluster, the NRC—and by extension the federal government—has helped Newfoundland diversify and modernize its economy. It is important to the federal government that, as Canada moves toward a knowledge-based economy or high-tech economy, less developed provinces like Newfoundland are not left behind.

Many interviewees provided evidence that the federal government seeks to create and promote innovation networks/clusters in *all* provinces. One of these interviewees, Program Officer 4, previously worked for the Natural Sciences and Engineering Research Council (NSERC), where she helped administer the Networks of Centres of Excellence (NCE) program. The NCE program, we will recall from previous chapters, was one of Canada’s first innovation network programs, funding dozens of virtual innovation networks over a span of thirty years. As a civil servant responsible for implementing the program, Program Officer 4 was required to

fund networks *across Canada*: “The head office of NSERC wanted the money to go across Canada. In order to show progress, the money couldn’t go to just, say, researchers in Vancouver. We had to submit reports showing that money is widely dispersed” (Program Officer 4). Another interviewee (Program Officer 7) currently works for the Canada Foundation for Innovation (CFI), which supports innovation networks indirectly by providing grants to universities and research institutions. Since CFI was founded in 1997, he explained, the organization has distributed grants using a ‘funding envelope’ system (Program Officer 7). Under this system, every university and major research institution in Canada can receive grant money from CFI, but only up to a certain limit. The University of Toronto, for example, cannot receive more than \$10 million. The main reason why this system exists is to ensure that grant money goes to universities and research institutions in *every province*. If this system did not exist, then all of the money would likely go to the largest and most prestigious universities and research institutions in Canada, all of which are located in Ontario, Quebec, Alberta, and British Columbia. A third interviewee, Program Officer 5, argued that the federal government’s most recent innovation network program, the Innovation Supercluster Initiative, touches every province and region of Canada. She also argued that the program supports entrepreneurs who live in small and rural communities, including Indigenous communities. Program Officer 5, it should be noted, is an administrator of the program.

Anchored Innovation Networks: A Closer Look

One of the theories presented in Chapter 4 was that provincial governments often invest in technology incubators, innovation hubs, and other physical innovation spaces due to pressure from urban political and economic elites. It was assumed that municipal politicians, local business leaders, and local economic development agents view innovation spaces as powerful

branding instruments for their cities, and thus try to convince provincial authorities to fund the construction, maintenance, and expansion of these spaces. Throughout the course of this research project, it was discovered that urban elites in Ontario and Alberta do, in fact, lobby provincial governments to fund innovation spaces. One instance of this occurred in Ontario in 2011, when elites from the municipalities of Burlington, Oakville, Milton, and Halton Hills collectively pressured the provincial government to fund a Regional Innovation Centre in Halton Region (Incubator Manager 5; Director 9). It is important to note, however, that urban elites not only seek funding from provincial authorities, but also from federal authorities. This was made clear by one interviewee, Manager 3, who works as a business development manager for a municipal government in southern Ontario. In 2021, Manager 3 tried to secure funding for a new incubator/accelerator from the Ontario Centre for Innovation (a provincial agency) and from FedDev (a federal agency):

“There is a mental health institute in [my city] that currently wants to create an accelerator and incubator that is focused on mental health issues. About a year ago, the institute came to me with this idea and I was like ‘okay, now where do we take this? We need some funding to get this off the ground’. Together, we went to the Ontario Centre for Innovation and said ‘here’s the concept, what kind of feedback do you have? How do we get this funded? What role could you play?’ After that, I made an introduction between the institute and FedDev, and again we said ‘this idea has legs, and there’s a business case here. How can we get some funding to get this off the ground?’ Right now, it’s up to FedDev to decide if there is some value in providing funding based on the business case” (Manager 3).

There are many different ways in which municipal governments help create and maintain physical innovation spaces, other than lobbying for federal and provincial funding. Sometimes they donate buildings to local universities and research institutions, which transform them into vibrant innovation spaces (Director 5). They also provide seed capital, operating grants, property tax deferrals, and preferential utility rates to the owners/operators of innovation spaces (Policy Analyst 1; Director 8). Some municipal governments in Ontario and Alberta are partnered with

local economic development corporations, which are semi-public organizations dedicated to growing the local economy, attracting foreign investment, and promoting the city to outsiders. Like municipal governments, these organizations provide both financial and in-kind support to physical innovation spaces. Some of them even create and operate their own spaces. For example, in 2017, the Burlington Economic Development Corporation built a large facility in east Burlington called Tech Place, which contains offices and co-working spaces for entrepreneurs (Burlington Economic Development, 2017, p10). The facility also houses a Regional Innovation Centre called Haltech, which provides tenant entrepreneurs with free mentorship, training, and networking opportunities. More recently, Innovate Edmonton, an economic development corporation founded in 2020, took over an existing technology incubator in downtown Edmonton called Startup Edmonton. According to a member of the corporation, Startup Edmonton is a place where “entrepreneurs and founders can come together, share ideas, and access boardrooms, meeting rooms, and open areas to bounce ideas around” (Program Officer 10). Innovate Edmonton is currently in the process of building a new, much larger incubator in downtown Edmonton (Innovate Edmonton, 2021, p41).

As we saw in Chapter 4, physical innovation spaces have the ability to attract attention, entrepreneurial talent, and investment from around the world to their cities or locales. Depending on their size and profile, they can help cities brand or market themselves as innovative places where creativity, ingenuity, and invention are welcomed and supported. Of course, the more impressive a space is from a visual and design standpoint, the more effective it is as a branding or marketing tool. The innovation spaces encountered during this research project varied considerably in their size, layout, and design. Some of them were rather small and modest, containing just a few private offices and an event room or co-working room. Others were much

larger, containing a communal laboratory, makerspace or workshop, auditorium, restaurant/cafe, and other amenities. Perhaps the most impressive innovation spaces were the MaRS Centre in Toronto, the Life Sciences Innovation Hub in Calgary, and Communitech in Waterloo. Although not yet complete, one technology incubator in downtown Oakville promises to be quite large and visually striking. This incubator was described in vivid detail by one interviewee, Director 9, who works for the municipal government of Oakville:

“Oakville is in the process of creating a cultural hub within our downtown, and that space is going to be a place for artistic and technological innovation. I’m sure you’ve read many papers that say that art and technology go hand-in-hand, and there are a lot of synergies that happen there. So we’re hoping to create a space where artists can come in (ones that deal with 3D, painting, woodworking, clay, whatever) and work in the same space as our tech entrepreneurs (individuals who are tinkering with robotics or whatever it is that they’re working on). Also, we’re hoping to move our downtown library into that cultural hub space as well. The building is an old post office that the Town of Oakville has gotten possession of. It’s very historical looking, it has a heritage aesthetic appeal. When you’re inside the building, you can see brick and beam mortar and all of the HVAC work, so the building has that industrial feel too. And it’s located downtown within walking distance to a lot of nice eateries and coffee shops. It’s a close distance to the lake. We’re trying to create an area where a lot of different senses come together—taste, touch, nature, tech, art—and really be able to create a space where you can let your imagination run wild and see what happens” (Director 9).

Like the Oakville incubator described above, a new incubator in Edmonton promises to be eclectic in its visual design and diverse in its clientele. Owned and managed by Innovate Edmonton, this incubator will possess “a unique collection of visual, cultural, natural, and social qualities”, allowing it to contribute to the revitalization (and branding) of Edmonton’s downtown area. Once it is completed, it will include “18,000 square feet of loft-style space with natural light and awe inspiring wrap-around windows, collaboration spaces, a 100-seat programming room, a pitch stage, a podcast and production studio, a café, and an event amphitheatre” (Innovate Edmonton, 2021, p41).

In order to help cities market or brand themselves in the global economy, innovation spaces cannot simply have large offices and laboratories with interesting architectural and design features. They must also have programs and services that provide financial, logistical, and networking support to innovative business ventures. As these ventures grow in size and profile, they draw national and international attention to their cities of origin, thus serving as unofficial ambassadors or promoters of these cities (Incubator Manager 3; Program Officer 10). Some innovation spaces in Ontario and Alberta help their ventures gain public visibility through press releases, publications, conferences, and other means. For example, the MaRS Centre in Toronto regularly profiles its most impactful and fastest-growing ventures in its annual reports. Using a compelling narrative style, these reports highlight the novelty, bold vision, and strong market performance of each venture (MaRS Discovery District, 2018, p13; MaRS Discovery District, 2021, p20). MaRS also informs international science and technology journalists about these ventures: “MaRS actively seeds stories about its portfolio of ventures in national and international media. Not only does media coverage help put Toronto and Canada on the world stage as a hub for innovation, it also attracts a diverse talent pool for innovative ventures and helps ventures scale as companies with global recognition and markets” (MaRS Discovery District, 2018, p28). Another high-profile innovation space, Communitech in Waterloo, hires university students across Canada to promote its ventures on university campuses, and to “serve as champions for the Waterloo region’s tech community” (Communitech, 2015).

In their article titled *Understanding Networks in Technology-Based Incubators* (2012), Creso Sa and Hana Lee suggest that technology incubators not only bring entrepreneurs together under the same roof, but also foster dialogue and collaboration between them through community-building programs and initiatives. This is certainly the case with technology

incubators in Ontario and Alberta, as revealed by interviews with incubator managers. For example, one technology incubator in southern Ontario hosts a networking event every week called 'Milestone Pizza', which is attended by all tenant entrepreneurs (Incubator Manager 4). During this event, entrepreneurs casually discuss their latest successes, breakthroughs, and challenges while enjoying a communal meal. They not only share their personal stories and experiences, but also give constructive feedback and practical advice to other participants. Another incubator in southern Ontario has a room dedicated to networking events, workshops, group training sessions, and other community-building activities. In addition, this incubator has staff members who identify entrepreneurs with complementary skills and abilities, and then encourage them to talk to each other and work together (Incubator Manager 6). Most incubators in Ontario and Alberta employ their own business mentors, who guide and support tenant entrepreneurs as they develop new products and grow their businesses. These mentors often have personal connections to universities, research institutions, government agencies, product design firms, and other organizations within the wider innovation ecosystem. As a result, they are able to refer their clients to academics, researchers, venture capitalists, legal experts, product design specialists, and other professionals if needed (Incubator Manager 4; Incubator Manager 5; Incubator Manager 6).

Inter-Governmental Relations: A Closer Look

During the research process, interviews were conducted with a number of individuals who work for municipal governments, local economic development corporations, and municipal associations in Ontario and Alberta (Manager 2; Manager 3; Program Officer 10; Director 4; Director 5; Director 9). These interviewees were asked to describe the power dynamics between municipal and provincial governments in Canada, and to explain how these dynamics have

changed over time. One interviewee (Director 5) argued that municipal governments have become much more powerful relative to provincial governments, as theorized in Chapter 4. This is most evident in Ontario, he suggested, where municipal governments have gained considerable influence over public policy at the provincial level. This increase in municipal power can be attributed partly to the growing importance of the Association of Municipalities of Ontario (AMO), an organization that represents municipal interests. Whenever a premier or provincial cabinet minister in Ontario proposes a new policy that may impact cities in some way, he or she must consult with members of AMO. Although AMO cannot veto provincial policies, it can shape them by providing advice and analysis, raising concerns, and suggesting changes and amendments. According to Director 5, the provincial government has become increasingly receptive to AMO's policy advice, because it is less able to conduct its own independent policy research. Most provincial ministries no longer employ their own subject matter experts, making them much more reliant on information from outside actors and organizations (like AMO).

Not every interviewee who works in the 'municipal sector' believed that municipal governments in Canada have become more powerful compared to provincial governments. One interviewee, Manager 2, argued that municipal governments continue to exist under the proverbial shadow of provincial governments, even though cities have grown significantly in population and economic strength. She noted that in Ontario, municipal governments have "pretty broad authority to pass bylaws and to implement policies and programs that they feel would benefit their local communities". Despite having this policy autonomy, however, these governments are still "creatures of the province"—in other words, they are still subordinate to the provincial government, and must adhere to provincial dictates and rules. One of these rules, for instance, strictly prohibits municipal governments from running budget deficits, making it

difficult for them to adapt and respond to economic crises. Director 2 also noted that, under Ontario's 2003 Municipal Act, the provincial government has a duty to consult with AMO on all matters affecting cities. In practice, however, the provincial government tends to ignore policy advice from AMO members, or resist implementing their ideas and suggestions. This means that AMO—the primary advocacy body representing municipal interests—has little actual influence over provincial policy.

Based on the documentary and interview data gathered, it is unclear whether or not municipal governments in Canada (or indeed just in Ontario and Alberta) have generally grown in power in recent decades. This question cannot be adequately addressed here, given the particular scope of this research project. What is absolutely clear, however, is that municipal governments are highly unequal in their levels of power. Municipal governments that serve large cities, such as Toronto, Ottawa, and Calgary, can easily gain the attention of federal and provincial authorities, negotiate with these authorities, and win concessions from them. Those that serve small cities and towns, on the other hand, lack the wherewithal to effectively engage with higher levels of government. As very marginal players in Canada's national political arena, small-city municipal governments carry little weight in inter-governmental relations. It is not only difficult for these governments to lobby federal and provincial governments for certain policies, but also to simply communicate with federal and provincial officials. One interviewee who works for the municipal government of a small town in southern Ontario complained that provincial officials often ignore her requests and inquiries, but respond regularly and swiftly to her counterparts in Toronto, Ottawa, Hamilton, and other large cities (Director 9).

One of the most interesting discoveries of this research project is that some cities receive substantial federal and provincial funding to create and maintain physical innovation spaces,

while others receive very little funding. A number of interviewees who work in the municipal sector testified to this reality. For example, Director 4 pointed out that the Regional Innovation Centres (RICs) in Toronto, Ottawa, and Waterloo receive generous grants and allowances from the federal and Ontario governments, allowing them to accommodate hundreds of tenant entrepreneurs and deliver large-scale programs and services every year. In contrast, the RICs in London, Windsor, Thunder Bay, Kingston, and Sudbury receive very modest funds, forcing them to limit the scale of their operations and use their resources sparingly. Another interviewee, Director 7, pointed out that all of the largest and most sophisticated technology incubators and accelerators in Alberta are located in just four urban centres—namely Calgary, Edmonton, Red Deer, and Lethbridge. When asked why some cities receive more federal and provincial funding for innovation spaces than others, these interviewees offered four different explanations. First, some cities (especially large ones) have powerful municipal governments that can effectively lobby federal and provincial governments for funding (Director 9). Second, some cities have large academic and entrepreneurial communities, and thus many potential users of innovation spaces (Director 7). Third, some cities have many organizations (business associations, educational institutions, financial institutions) that can provide co-funding for innovation spaces, write letters of support for funding applications, and establish channels of communication with federal and provincial policymakers (Director 4). Fourth, some cities have many voters, making them very attractive targets for federal and provincial spending (especially during election periods) (Director 9).

Three Grounded Theories for Future Research

As an inductive research project, this dissertation sought to develop new theories that can be further explored, refined, or tested by future researchers. Throughout the research process,

three compelling theories emerged, each one well-grounded in empirical observation. These theories are as follows:

Theory 1

Since the mid-1980s, Canada's federal and provincial governments have created, funded, and supported innovation networks in a wide range of industrial sectors, including manufacturing, agriculture, biotechnology, information technology, energy, and transportation. Each government has focused on networks in a particular sector or set of sectors depending on its industrial policy history. For example, the provincial government of Alberta has focused on networks in agriculture and energy, because Alberta's past industrial policies have largely revolved around these two industries. While there appears to be a certain amount of path dependency it is not absolute, as the federal government's Global Innovation Clusters (previously the Supercluster program) and its recent budgetary initiatives show.

Theory 2

Canada's federal and provincial governments both fund physical innovation spaces, such as technology incubators, science parks, innovation hubs, and communal research laboratories. It was the impression of research participants that these governments provide different kinds of funding to these spaces. The federal government prefers to provide short-term capital funding, although examples of the provision of operational funding certainly exist. Meanwhile, provincial governments prefer to provide long-term operational funding, though they certainly also make capital contributions. These different approaches to funding innovation spaces reflect the different geopolitical and geoeconomic conditions facing federal and provincial governments. Since Confederation, there have been

significant economic disparities between provinces and regions in Canada. These disparities have often led to inter-provincial and inter-regional conflict, thus undermining national political unity. In order to stave off such conflict, the federal government has tried to ensure that every province and region of Canada can advance economically, or at least maintain a relatively high level of economic performance. Given its strong commitment to promoting regional economic balance and equality, the federal government feels compelled to fund physical innovation spaces *across the country*, from the Atlantic to the Pacific coasts and from the urban south to the more rural north. Due to fiscal constraints, however, the federal government cannot cover the operating expenses of hundreds of innovation spaces throughout Canada. It can, however, cover short-term project expenses (i.e capital expenses). In contrast, provincial governments are able to cover the operating expenses of innovation spaces, because they have much fewer of these spaces within their jurisdictions.

Theory 3

Cities across Canada wish to build, maintain, and expand physical innovation spaces (technology incubators, innovation hubs, etc), because these spaces have the ability to attract attention, talent, and investment from around the world. In order to create and support these spaces, however, cities must call upon federal and provincial governments to provide both capital and operational funding. It is easier for some cities to secure federal and provincial funding for innovation spaces than others. Cities with powerful municipal governments, expansive entrepreneurial and academic communities, large voter populations, and politically well-connected local organizations are the most able to secure such funding. In Ontario, these cities include Toronto, Ottawa, and Waterloo, while in Alberta they include Calgary, Edmonton, and Lethbridge.

While all three theories laid out above may be persuasive and credible based on the evidence gathered, they should be subjected to rigorous empirical tests. The first theory can be tested by systematically comparing innovation network policies and past industrial policies in multiple provinces. Through these comparisons, researchers can determine whether, and to what degree, innovation network policies are technologically aligned with past industrial policies. Perhaps a ‘technological alignment index’ can be established for each province using statistical methods. The second theory can be tested by obtaining financial records from technology incubators, innovation hubs, and other physical innovation spaces, as well as from government ministries and agencies that fund these spaces. By gathering and analyzing these records, researchers can confirm whether federal and provincial governments provide different kinds of funding (operational and capital) to innovation spaces. Of course, in order to fully test this theory, researchers must also explore how federal and provincial funding habits and patterns are influenced by geopolitical forces. This would likely require researchers to interview federal and provincial policymakers, program officers, and possibly elected officials. Finally, the third theory can be tested through two stages. The first stage involves selecting a diverse sample of ten or more Canadian cities. These cities can be located in just one province or spread out across the country. Once a sample has been selected, researchers can rank these cities based on the number of physical innovation spaces they have (or the amount of federal and provincial funding they receive for anchored innovation networks). High-ranking cities may have dozens of innovation spaces, many of which receive substantial federal and provincial grants and allowances. Conversely, low-ranking cities may have just one or two innovation spaces, both of which receive minimal funding from higher levels of government. The second stage involves comparing the characteristics of high-ranking and low-ranking cities in order to determine the *causes* of these

different rankings. One would expect high-ranking cities to have more powerful municipal governments, larger entrepreneurial and academic communities, larger voter populations, and stronger local organizations than low-ranking cities. Researchers may discover, however, that other characteristics (or independent variables), such as industrial composition and local GDP, are also important (or even more important than the ones just mentioned).

During the writing of this dissertation, new research questions were developed that deserve scholarly attention, all of which relate to innovation network policies in Canada. One question concerns the relationship between innovation network policies and political parties. As we saw in Chapter 6, all major political parties in Canada have supported the creation and growth of innovation networks at various points in time. It is unclear, however, if some political parties are more committed to supporting innovation networks than others, or if different political parties have different conceptions and understandings of innovation networks, and thus different orientations toward innovation network policy. This research question indirectly touches on the nexus between *political ideology* and innovation network policy. Another research question concerns the evolution of innovation network policies over time, and the social and political forces driving this evolution. Since they were first introduced in the mid-1980s, these policies have undergone changes in terms of their structure, methods, and overall strategies. The exact nature, sequence, and causes of these changes are unclear, however. Perhaps the evolution of innovation network policies reflects changes in innovation network theory, government priorities, or public policymaking practices and conventions. A third research question takes an international perspective: how are innovation network policies in Canada different from those in other countries? What historical, institutional, geopolitical, and economic factors explain these differences?

Conclusion

Since the 1980s, Canada's federal and provincial governments have recognized that innovation—that is, the development of new products, technologies, and production processes—is the key to Canada's future economic competitiveness and prosperity. They have also recognized that innovation requires *collaboration* between highly-skilled professionals in different sectors of society (industry, academia, finance, etc). In their view, it is important that these professionals exchange scientific and technical knowledge, share equipment and other assets, and collectively devise solutions to complex technical challenges. In an effort to spur such collaboration, these governments have created, funded, and promoted 'innovation networks' across Canada. Innovation networks are groups of entrepreneurs, academics, researchers, graduate students, investors, and other actors who work together to identify societal and industrial problems, and then carry out technological innovations that address these problems. Some innovation networks are completely virtual, while others are rooted in real, tangible places, such as technology incubators and accelerators, innovation hubs, science parks, and communal research laboratories. These networks are usually funded and supported through dedicated government programs, such as the federal government's Networks of Centres of Excellence program and the Ontario government's Jobs and Prosperity Fund.

Ever since Canada's federal and provincial governments began creating and supporting innovation networks in the 1980s and 1990s, political scientists, economists, and economic geographers have taken an interest in these initiatives. Many of these scholars have studied the intricacies of specific innovation network programs, including the Ontario Centres of Excellence program (Bell, 1996), the Sector Partnership Fund (Clarkson, 1999; Wolfe & Gertler, 2001), the Networks of Centres of Excellence program (Fisher, Atkinson-Grosjean & House, 2001;

Atkinson-Grosjean, 2006), and the Innovation Supercluster Initiative (Doloreaux & Shearmur, 2018). These scholars deserve praise for vividly describing and characterizing these programs, and for situating them within their political and historical contexts. Because of the cumulative efforts of these scholars, there is now a substantial and respectable body of literature on innovation network policy in Canada. This body of literature has some major gaps, however, one of which is that it completely lacks any comparative perspective. As we saw in Chapter 3, no scholars have ever compared innovation network programs in different provinces, nor have they compared them at the federal and provincial levels.

The purpose of this dissertation was to fill the gap in the literature identified above. It sought to determine whether federal and provincial innovation network programs are different from each other and, if so, how they are different. It also sought to determine *why* these programs are different (or not different), paying particular attention to geopolitical and historical-institutional factors. Ontario and Alberta were the only provinces included in this research project due to limitations of time and resources. Two different methods were used to gather information. The first method was the collection and analysis of documents published by government ministries and agencies, local economic development corporations, technology incubators/accelerators, and private research firms. These documents described, with varying levels of detail, the missions, structures, and operations of innovation network programs. The second method involved interviewing policymakers, civil servants, business development professionals, and other individuals within Canada's innovation ecosystem. Some of these individuals directly oversaw the implementation of innovation network programs, while others were either directly or indirectly impacted by these programs. In total, 309 documents were analyzed and 41 individuals were interviewed.

As data was collected through document analysis and interviews, it was discovered that federal and provincial innovation network programs are in fact different. One of the ways that they differ is by focusing on innovation networks in different industrial or technological sectors. Federal programs focus heavily on networks in the agriculture and health sectors, while provincial governments focus on those in other sectors, such as manufacturing, energy, and aerospace. Another way in which these programs differ is by providing different kinds of funding to anchored innovation networks; federal programs tend to provide these networks with short-term capital funding, while provincial programs provide them with long-term operational funding. It was also discovered that anchored innovation networks receive different levels of government funding (both federal and provincial) depending on where they are located—specifically, which cities they reside in. Anchored networks in Toronto, Waterloo, and Edmonton, for example, receive exorbitant federal/provincial grants and allowances. In contrast, those in London, Windsor, and Grand Prairie receive modest stipends (sometimes barely enough to cover their basic expenses). It should also be noted that some cities have more anchored networks within their borders or jurisdictions than others. For example, the city of Waterloo has far more anchored networks than the city of London, despite having a much smaller population.

Throughout the course of this research project, a number of empirically-grounded theories were developed to explain the research findings discussed above. One of these theories posits that federal and provincial governments target innovation networks in different industrial or technological sectors because they have different industrial policy histories and experiences. The federal government targets networks in the agriculture and health sectors because it has consistently supported these two sectors in the past through the National Research Council, the Medical Research Council, and the Department of Agriculture. Similarly, the provincial

government of Ontario targets networks in the manufacturing sector because this sector has been the primary focus of industrial policy in Ontario since the late nineteenth century. Another theory posits that federal and provincial governments provide different kinds of funding (capital and operational) to anchored innovation networks because they operate under different geopolitical conditions and logics. Since the mid-twentieth century, the federal government has been committed to promoting regional economic balance/equality or regionally-inclusive economic growth. It feels compelled, therefore, to fund anchored innovation networks in *every* region of Canada, not just in wealthy or economically-advanced regions. The federal government can only fund anchored networks across the country, however, by providing them with short-term capital funding. In contrast, provincial governments are able to provide these networks with long-term operational funding due, in part, to the fact that they have smaller jurisdictions than the federal government. The final theory relates to the unequal distribution of federal and provincial funding for anchored networks among Canadian cities. As we saw above, different cities receive different levels of federal and provincial funding to create, maintain, and expand anchored innovation networks. The city of Toronto, for example, receives substantial funding while the city of London receives very little. This is because Toronto is able to effectively *lobby* federal and provincial governments for such funding. Cities with strong lobbying capacities usually possess certain characteristics, such as powerful municipal governments, expansive entrepreneurial and academic communities, large voter populations, and politically well-connected local organizations.

The three theories outlined above have profound implications for both innovation network policy in Canada and the future performance of Canada's economy and system of innovation. The first theory implies that there are barriers that Canada's federal and provincial

governments must overcome in order to invest in innovation networks in particular industrial sectors, specifically those sectors that are novel or unfamiliar, or that have not been subject to past industrial policies. This could be problematic, as barriers to investing in these networks could lead governments to forego opportunities to strengthen, diversify, and modernize Canada's national and provincial economies. Further exploring how and when policy actors can break free of the constraints imposed by path dependency will be an important avenue for future research. The second theory implies that Canada's current system for funding technology incubators, innovation hubs, and other anchored innovation networks is deeply flawed. Under this system, anchored networks can only obtain long-term operational funding from provincial governments. During times of provincial economic turmoil or political transition, provincial governments may choose to reduce operational funding for anchored networks, thus placing these networks under extreme financial stress. Unable to obtain replacement funding from the federal government, these networks may need to dramatically scale back their operations by firing staff, cancelling programs, and selling off buildings and other assets. Finally, the third theory implies that the distribution of federal and provincial funding for anchored networks may change as Canada's urban system continues to develop and evolve. By testing and further developing these three theories, researchers can not only enhance our understanding of Canada's innovation policy domain, but also generate information that is highly useful to federal and provincial policymakers concerned with innovation. It is only by exploring these questions that we can improve Canada's innovation performance, which is quite poor by international standards.

Methodological Appendix

The purpose of social science research is to illuminate and explain certain aspects of society or social life, either at the micro-level (individuals, families, organizations) or at the macro-level (social classes, states, nations). The first step to carrying out a research project in the social sciences is identifying a compelling research question that has not yet been answered by scholars (or at least not fully answered). Once a question has been chosen, one must select a research method—or, more commonly, a set of research methods—that are suitable for answering the question at hand. Every method has its own specific rules for collecting, processing, analyzing, and presenting empirical data. These rules have been carefully developed and laid out by social scientists in research manuals and methodology papers over many decades. This methodological appendix will provide a general overview of research methods in the social sciences. First, it will distinguish between *quantitative* and *qualitative* methods and between *deductive* and *inductive* methods. It will then situate this dissertation methodologically. Lastly, it will explain how data was collected and analyzed throughout the research process.

Research Methods in the Social Sciences

All elementary research methods courses and textbooks distinguish between two main research traditions: quantitative research and qualitative research. Quantitative research seeks to understand the social world through precise measurement, tabulation, and statistical analysis (Scott & Garner, 2013, p9; Yilmaz, 2013, p313). It relies heavily on random sampling, questionnaires, and surveys for the collection of information, which is often expressed in numeric form. In contrast, qualitative research seeks to understand the social world by considering the views, thoughts, opinions, behaviours, experiences, and practices of particular individuals or social bodies (Yilmaz, 2013, p314). The most common method of collecting

information in qualitative research is interviews, during which researchers ask people open-ended questions about their personal lives, past experiences, hopes for the future, and feelings about various issues and topics. Sometimes, interviews are conducted in a formal and highly-structured fashion, with the researcher asking people predetermined and standardized questions in a particular order. Other times, interviews are conducted in a casual and unstructured fashion, with the researcher asking people improvised questions in no particular order (Lichtman, 2014, p248).

Aside from the distinction between quantitative and qualitative research, there is also a distinction between *deductive* and *inductive* research. In deductive research, the researcher begins with a theory developed either by himself/herself or by another researcher. The theory may explain a particular social, economic, or political phenomenon. For example, it may explain why crime levels decreased in Canada in the 1990s, or why an ultra-nationalist, far-right party was elected to power in Italy in 2022. Alternatively, the theory may establish a general social, economic, or political principle that is presumably universal. It may posit, for instance, that large welfare states can only exist in countries with powerful workers' parties or with expansive and well-organized labour movements. After identifying a particular theory, the researcher collects and analyzes data in an effort to confirm the theory or test its validity. Data may be collected from a variety of sources, including documents, historical records and accounts, interviews, questionnaires, and national-level or regional-level surveys. The data must be collected and analyzed in a thorough, systematic, and rigorous manner, otherwise the theory in question cannot be properly tested. Of course, researchers can test theories through both quantitative methods—like regression analysis—and qualitative methods—like process-tracing and comparative case study analysis (Collier, 2011; Ricks & Liu, 2018, p843-845).

Inductive research can be viewed as the polar opposite of deductive research (Eisenhardt, 2007, p25). Whereas deductive research seeks to test an existing theory, inductive research seeks to develop an entirely *new* theory. Also, whereas deductive research proceeds from theory to empirical data, inductive research proceeds from empirical data to theory. At the beginning of an inductive research project, the researcher chooses a research question—for example, why do some countries have powerful far-right political parties, while others do not? With this question in mind, the researcher chooses certain countries (or ‘cases’) to study, and then proceeds to gather pertinent information from each country. This information might relate to demographics, economic performance, social stratification, ethnic conflict, political institutions, political stability, and social and political history. Following the information-collection process, the researcher attempts to find an answer to the research question by identifying themes, patterns, and causal relationships in the information gathered. Once a potential answer has been found, the researcher is able to develop a cogent and testable theory. The theory may state, for instance, that powerful far-right parties emerge in countries with high unemployment levels, aging populations, and fascist political histories. At the end of the research project, the researcher may invite his or her colleagues to critique, test, and further refine the theory.

Many of the ‘classic’ social scientists of the eighteenth and nineteenth centuries, such as Adam Smith (1982 [1776]), John Stuart Mill (2008 [1848]; 2015 [1859]), Karl Marx (1963 [1852]; 1992 [1867]), and Ferdinand Tönnies (2001 [1887]), practiced inductive research. These venerated scholars developed grand, original theories on various economic and sociological issues, including industrial development, class conflict, social transformation, and the relationship between the individual and society. In order to develop these theories, they examined major historical events, social forces and institutions, and socio-economic trends

across time. The early twentieth century saw the rise of a new generation of social scientists, one that was also interested in inductive research and theory-building. Unlike their classic forebears, these scholars preferred to examine small-scale social units, such as neighbourhoods, families, and individuals (Scott & Garner, 2013, p16-26). Using participant observation and other methods, they studied the regular, everyday lives and experiences of people from all segments of society. By doing so, they hoped to uncover general ‘sociological laws’ or ‘laws of social change’ that could potentially guide and inform social policy (Thomas & Znaniecki, 1918; Hammersley, 1989, p67).

As we just saw, inductive research proceeds from data collection to theory-building or theorization. During the inductive research process, researchers collect empirical data from the field through interviews, observations, document analyses, and other means. They then use the field data collected to generate new socio-cultural, political, and economic theories. It is important to recognize, however, that researchers always begin the inductive research process with existing theoretical and conceptual knowledge. This knowledge may come from their professional and academic training, their exposure to existing literature, or their previous research experiences. Whether consciously or unconsciously, researchers often allow their existing knowledge to guide and direct the collection of data in the field. This knowledge may determine, for instance, which cases will be selected, which individuals will be interviewed, and which factors or variables will be examined. This point was made clearly by Greg Scott and Roberta Garner (2013), two sociologists with extensive qualitative research experience:

“The researcher never goes into the field as a *tabula rasa* (as a blank slate), recording everything indiscriminately. To quote Christopher Isherwood: ‘I am a camera’ — yes, but a camera pointed in some directions more frequently than others and with specific settings for the focal distance! Concepts and categories guide the fieldwork (or the documentary analysis) from the start and are implicit or explicit in the research questions. Whether or not we explicitly state the theoretical foundations of our work, these foundations are

present; they are like a set of concept boxes which we set up and into which we start throwing the data...The choice of groups or sites to compare, the process of observing and writing field notes that became part of the textual database, the choice of documents, the choice of interview subjects and topics—all of these components have already been shaped by the researcher’s pre-existing system of categories” (Scott & Garner, 2013, p96).

According to Scott and Garner, researchers not only enter the field with prior theoretical and conceptual knowledge, but also with ‘working hypotheses’—that is, tentative answers to the research questions being investigated. As empirical data is collected and analyzed, some of these hypotheses are disproven and discarded, while others are developed into strong, empirically-grounded theories.

In his article titled *From Methodology to Practice: Inductive Iteration in Comparative Research*, political scientist Sean Yom describes the inductive research process as a “dialogue between theory and data”. At the beginning of the process, Yom explains, researchers develop *a priori* theories about particular social phenomena. These theories are simply ‘hunches’ or conjectures based on intuition and prior knowledge—in other words, they are what Scott and Garner call ‘working hypotheses’. After collecting and analyzing data, the researchers may discover that their initial theories are incorrect or incomplete. Instead of rejecting these theories, however, they update and improve them based on the empirical data that was uncovered. Oftentimes, researchers move back and forth between theorization and data analysis until they arrive at strong grounded theories. Yom refers to this process as ‘inductive iteration’:

“A project utilizing inductive iteration differs from the deductive paradigm in three ways. First, scholars begin the research process having delineated a clear phenomenon of interest, but do not necessarily deduce full-fledged hypotheses from existing theories and axioms. However, they must at least develop what Michael Mann (1994) called ‘theoretical hunches’—causal priors, explanatory conjectures, and other ideas that make some provisional claims about causal relationships...Second, after collecting data and cases to analyze, investigators must assess whether they fit with the nascent proposition, and in explicit context with rival theories and arguments. The goal is to produce a theoretically grounded and internally rigorous explanation that can satisfactorily account for most or all observed outcomes. If they cannot account for what is observed based on their priors, or

they encounter new and useful information, scholars return to theorizing. They refine and improve the budding causal framework, often by reinterpreting existing evidence, securing more data, or invoking further theoretical inspiration. They return to the data and cases to assess the fit, and so forth. Third, this repeating cycle of theory-data dialogues does not necessarily terminate with one decisive hypothesis test. Squeezed into the vocabulary of deductive proceduralism, investigators instead make numerous and non-binding ‘tests’ in which mismatches with data entail adaptation rather than termination of the argument” (Yom, 2015, p625-626).

According to Yom, many important scholarly works in the field of political science have relied on inductive iteration. Some of these works include Barrington Moore’s work on economic and political modernization (Moore, 1966), Theda Skocpol’s work on social revolutions (Skocpol, 1979), Charles Tilly’s work on state formation (Tilly, 1990), and Kathleen Thelen’s work on worker training regimes in Western Europe (Thelen, 2004). As we will see, this dissertation also uses inductive iteration.

Framing the Dissertation

In the 1980s and 1990s, many economists and economic geographers discovered that industrial innovation is a collaborative and interactive process. In every advanced economy, firms, universities, and other organizations work together to create new products, productive technologies, and production processes. Upon this discovery, scholars began developing theories about ‘innovation networks’ and ‘innovation clusters’ (Freeman, 1987; Lundvall, 1988; Nelson, 1990; Porter, 1990; Saxenian, 1996; Edquist & Johnson, 1997). These theories explained how organizations in different sectors help each other carry out innovations by sharing technical knowledge, market intel, personnel, equipment, and other resources. They also explained how inter-organizational collaboration is supported and enabled by certain institutional arrangements (economic, legal, and cultural) and government policies. All of these theories were informed by empirical research; they were developed over many years through the examination and analysis of real-life case studies. For example, Bengt-Åke Lundvall developed his theory of ‘user-

producer interaction' by examining the relations between user and producer firms in many different industries and institutional contexts. Similarly, AnnaLee Saxenian developed her theory of 'regional network-based industrial systems' by examining innovative activities and inter-firm dynamics in Silicon Valley. Innovation network/cluster theories are thus *products of inductive research*.

As we will see in the literature review in Chapter 3, many Canadian political scientists and economists have written about innovation network policies in Canada (Bell, 1996; Clarkson, 1999; Fisher, Atkinson-Grosjean & House, 2001; Doern, Castle & Phillips, 2016; Doloreaux & Shearmur, 2018). None of these scholars have *compared* such policies at the federal and provincial levels, however. It is unclear from the existing literature whether federal and provincial innovation network policies are different from each other and, if so, how they are different. It is possible that these policies employ different techniques or methods for connecting entrepreneurs, academics, researchers, investors, and other innovative actors. They may also create and support innovation networks in different industries or areas of technology. This dissertation seeks to understand the similarities and differences between these policies through the collection and analysis of government documents, as well as the interviewing of civil servants and other individuals with direct knowledge of innovation network policies. The ultimate goal of the dissertation is twofold: first, to determine whether these policies are different from each other, and second, to develop theories as to *why* they are different (or not different). One may describe the dissertation, therefore, as a *qualitative-inductive* research study.

The previous section noted that researchers always begin the inductive research process with existing theoretical and conceptual knowledge, which often guides and directs the collection of data in the field. It also noted that researchers sometimes enter the field with working

hypotheses, which are gradually disproven, refined, and ‘worked out’ as field data is collected and analyzed. A few working hypotheses were formulated at the outset of this dissertation. One of these hypotheses was that the federal government primarily supports *virtual* innovation networks, because these networks are effective instruments for promoting regional economic balance. Conversely, provincial governments primarily support *anchored* innovation networks, because these networks serve the interests of local economic and political elites, many of whom have close ties to provincial leaders. Another (related) hypothesis was that municipal governments, local chambers of commerce, and other local-level organizations pressure provincial governments to fund anchored innovation networks. Chapter 4 will lay out these hypotheses in greater detail, and explain the geopolitical logic and reasoning behind them.

How Data Was Collected

Two different methods were used to gather information on innovation network programs and the organizations that design and execute them. The first method involved interviewing key individuals within Canada’s innovation ecosystem. Between August 2021 and July 2022, 41 individuals were interviewed over Zoom, a videoconferencing platform. These individuals were selected through a combination of purposive and snowball sampling. 23 interviewees were from Ontario, 12 were from Alberta, 3 were from Atlantic Canada, 2 were from Saskatchewan, and 1 was from Quebec. All interviewees worked for organizations that support or promote innovation networks in some way. 11 worked for federal ministries and agencies, 7 worked for provincial ministries and agencies, 11 worked for local governments and economic development bodies, and 12 worked for technology incubators and accelerators. Interviewees held a range of different titles, including program officer, program manager, policy director/analyst, executive director, and chief scientific officer. All interviews were guided by a set of standard questions (or ‘framing

questions’), however these questions were often changed, adapted, and expanded during the interview process as interviewees shared their thoughts, insights, and opinions. These framing questions are presented at the end of this appendix. There were two phases to the interviews. During the first phase, interviewees were asked specific questions about the organizations they work for and the innovation programs they oversee. During the second phase, they were asked broad questions about innovation policy in Canada (both at the federal and provincial levels), intergovernmental relations, and geopolitics.

The second method used to gather information was the collection and analysis of documents related to innovation networks and network programs. 309 documents were obtained from online databases—most notably the Scholars Portal Canadian Public Documents Collection and the Government of Canada Publications Archive—as well as from the websites of organizations. These documents were published by government ministries and agencies, local economic development corporations, technology incubators/accelerators, and private research firms. They included annual reports, policy reports, organizational reviews, strategic planning documents, program instructions, and program summaries and evaluations. Some search terms that were used to find the documents include ‘technology’, ‘technology incubator’, ‘innovation policy’, ‘innovation network’, ‘innovation cluster’, ‘collaborative research’, and ‘joint R&D’. Given the recency of the policy area (1985-present), and the thoroughness with which governments digitized their documents on innovation network policy, a virtual document search was sufficient; no physical search of national and provincial archives was necessary.

Once the research data was gathered (through both interviews and document analyses), it was systematically coded, categorized, and analyzed. This was done through two stages. First, data derived from federal sources, Ontario sources, and Alberta sources was separated and placed

into different folders. Within each folder, the data was sub-divided based on topic. Data that pertained to specific government programs was placed into one sub-category, while data that pertained to more general topics (for example, municipal-provincial relations) was placed into another sub-category. Second, a colour coding system was used to identify key themes and concepts in the data. This kind of data analysis is called “thematic content analysis” in the qualitative research literature (Lichtman, 2014, p318-320). During the process of data categorization and analysis, lists were created of government ministries/agencies and their associated network programs. These lists are presented in three tables throughout Chapter 6. While they are not comprehensive, the lists provide a historical and panoramic view of Canada’s innovation network policy field.

Philip Raines, a senior research fellow at the European Policies Research Centre, discovered that governments carry out innovation network/cluster programs through four different stages (Raines, 2002a, p163-172). During the first stage, governments survey the existing innovation landscape or ecosystem, and identify existing innovation networks and clusters with strong growth potential. They also identify existing organizations that have complementary skills and abilities, and should work together on innovative projects. During the second stage, governments consult with entrepreneurs, investors, industry experts and business leaders, academics, and researchers. Using the information provided by these actors, they develop plans to support network/cluster formation and growth. During the third stage, governments implement network/cluster programs, using various tools to foster collaboration between organizations. Finally, during the fourth stage, governments evaluate their network/cluster programs. These four stages can be observed in Canada, where both federal and provincial governments have thoroughly analyzed innovation ecosystems, planned and

developed innovation network programs, and implemented and evaluated these programs. Each stage of the policymaking process is illuminated by the documents gathered from government ministries and agencies, and by the interviews conducted with policymakers, civil servants, and other actors. The table below (Table 1) shows how different documents and interviews apply to different policymaking stages. It sorts the documents and interviews along two different axes: policymaking stage (analysis and planning, program implementation, and program evaluation) and level of government (federal, provincial, and local):

Table 4: Organization of Data

	Federal	Provincial (Ontario)	Provincial (Alberta)	Local
Analysis and Planning	<ul style="list-style-type: none"> • 15 documents from government ministries. • 7 documents from arms-length government agencies. 	<ul style="list-style-type: none"> • 3 documents from government ministries. • 2 documents from arms-length government agencies. 	<ul style="list-style-type: none"> • 8 documents from government ministries. • 14 documents from arms-length government agencies. 	<ul style="list-style-type: none"> • 26 documents from local economic development bodies (Ontario). • 1 document from local economic development body (Alberta).
Program Implementation	<ul style="list-style-type: none"> • 12 documents from government ministries. • 66 documents from arms-length government agencies. • 14 interviews. 	<ul style="list-style-type: none"> • 10 documents from government ministries • 29 documents from arms-length government agencies. • 11 interviews. 	<ul style="list-style-type: none"> • 21 documents from government ministries. • 16 documents from arms-length government agencies. • 7 interviews. 	<ul style="list-style-type: none"> • 16 documents from local economic development bodies (Ontario). • 4 documents from local economic development bodies (Alberta). • 23 documents from technology incubators (Ontario). • 18 interviews.

Table 4: Organization of Data

	Federal	Provincial (Ontario)	Provincial (Alberta)	Local
Program Evaluation	<ul style="list-style-type: none"> • 9 documents from government ministries. • 15 documents from arms-length government agencies. • 6 documents from private research firms. • 3 interviews. 	<ul style="list-style-type: none"> • 2 documents from government ministries. • 1 document from nonprofit research organization. • 2 interviews. 	<ul style="list-style-type: none"> • 6 documents from arms-length government agencies. • 1 interview. 	<ul style="list-style-type: none"> • 1 document from local economic development body (Alberta). • 4 documents from technology incubators (Ontario). • 1 document from technology incubator (Alberta). • 1 interview.

It should be noted that some documents and interviews apply to multiple policymaking stages—for example, some address both program planning and implementation. It should also be noted that, for the sake of simplicity, the first two stages (analysis and planning) have been combined within a single row.

Framing Questions

The following is the list of questions that were used to frame the interviews with the research participants. Three different sets of questions were used depending on which organizations the interviewees worked for (federal and provincial ministries and agencies, technology incubators and accelerators, and local governments and economic development corporations).

Framing Questions for Federal/Provincial Ministries and Agencies

1. What is your job title? What are your responsibilities?

2. I would like to know a little bit about the history of your ministry/agency. When was it created?

3. What is the overall goal or mission of your ministry/agency?

4. How does your ministry/agency help stimulate industrial innovation and entrepreneurship?
 - Please tell me about the [INSERT INNOVATION PROGRAM]. How does this program work?

5. My research looks at ‘innovation networks’—that is, groups of researchers, academics, and entrepreneurs who work together to develop new products and technologies. Does your ministry/agency help create or support innovation networks? If so, how?
 - How are these networks organized? How do they operate?
 - How are these networks geographically distributed throughout Canada/the province?
 - Are these networks local, regional, or national in scale? Do they link researchers, academics, and entrepreneurs located in different provinces and regions of Canada?

6. Does your ministry/agency create, fund, or support physical innovation spaces, such as technology incubators and accelerators, science parks, and innovation hubs?

7. Based on your observations, how would you describe the federal government's general approach to promoting innovation? What about innovation networks?

-Why does the federal government take this particular approach?

8. Based on your observations, how would you describe the provincial government's (Ontario, Alberta) general approach to promoting innovation? What about innovation networks?

-Why does the provincial government take this particular approach?

9. Which level of government (federal or provincial) is most likely to fund physical innovation spaces, such as technology incubators and accelerators, science parks, and innovation hubs?

Framing Questions for Technology Incubators/Accelerators and Innovation Hubs

1. What is your job title? What are your responsibilities?

2. What services does your incubator/accelerator/hub provide?

-Does it provide entrepreneurs with office and laboratory space?

-Does it facilitate collaboration between entrepreneurs, academics, researchers, product design specialists, and other professionals?

-Does it employ staff who can assist entrepreneurs with their innovative challenges?

3. Please describe the physical layout of your incubator/accelerator/hub.

-Does it contain co-working space?

-Does it contain private office space?

-Does it contain lab space?

-Does it contain event/conference space?

-Does it contain advanced technologies for research, testing, prototyping, product development, etc?

4. How was your incubator/accelerator/hub founded? Which actors played an important role in its creation?

-What role, if any, did the municipal government play in its creation?

-What role, if any, did local businesses, universities, and economic development corporations play in its creation?

-What role, if any, did the provincial/federal government play in its creation?

5. What kind of support does your incubator/accelerator/hub currently receive from the federal, provincial, and municipal governments?

-Which level of government provides the most support?

6. Does your incubator/accelerator/hub help brand, market, or promote your city/region to outsiders? If so, how?

7. Based on your observations, how would you describe the federal government's general approach to promoting innovation?

-Why does the federal government take this particular approach?

8. Based on your observations, how would you describe the provincial government's (Ontario, Alberta) general approach to promoting innovation?

-Why does the provincial government take this particular approach?

9. Which level of government (federal or provincial) is most likely to fund physical innovation spaces, such as technology incubators and accelerators, science parks, and innovation hubs?

Framing Questions for Municipal Departments and Local Economic Development Organizations

1. What is your job title? What are your responsibilities?

2. I would like to know a little bit about the history of your department/organization. When was it created?

3. In a general sense, how does your department/organization promote economic development in [INSERT CITY NAME]?

-Does your department/organization support local entrepreneurs and tech companies? If so, how?

-Does your department/organization conduct city-branding campaigns?

-Does your department/organization create, fund, or support physical innovation spaces, such as technology incubators and accelerators, science parks, and innovation hubs?

4. How would you describe the current relationship between the provincial government of [Ontario/Alberta] and municipal governments? Is it congenial and cooperative? Is it antagonistic?

5. Has the relationship between the provincial and municipal governments changed over time? If so, how?

-Has it become easier or harder for municipal governments to communicate with the provincial government?

-Has it become easier or harder for municipal governments to shape or influence economic policy at the provincial level?

-Has it become easier or harder for municipal governments to challenge provincial policies they disagree with?

-Has it become easier or harder for municipal governments to lobby the provincial government for infrastructure funding?

6. Why has the relationship between the provincial and municipal governments changed? What factors can explain this?

7. Based on your observations, how would you describe the federal government's general approach to promoting innovation?

-Why does the federal government take this particular approach?

8. Based on your observations, how would you describe the provincial government's (Ontario, Alberta) general approach to promoting innovation?

-Why does the provincial government take this particular approach?

9. Which level of government (federal or provincial) is most likely to fund physical innovation spaces, such as technology incubators and accelerators, science parks, and innovation hubs?

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