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Innovation policy in Canada's agri-food system: The functional food and natural health products' segment

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Any remaining errors are my responsibility.

Declaration

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Abstract

Public policy regarding innovation in the Canadian value-added agri-food sector does not appear to meet its intended outcomes. Rather than being a commodity producing nation, Canada has attempted to focus its attention on adding value to products that increase economic returns. Innovation capacity and ability to capture opportunities appear to be limiting factors.

This research therefore conducted a general review of the food system in Canada with a specific focus on innovation in the functional food and natural health products' (nutraceutical) sector. The findings are based on interviews with forty representatives of the key actor groups in innovation: industry, academia, government and civil society.

The research concluded that the food system is comprised of complex demand networks that include global players working on various elements of innovation. The growing complexities are causing challenges for all actor groups. One major challenge is the lack of a common understanding of the concept of innovation within or among the actor groups including policy-makers. This finding puts into question any policies and measurements currently in place.

The research adds new knowledge by expanding the multi-dimensional definition of innovation to include human elements. The research also shows that federal policy as it affects innovation in the Canadian high value-added agri-food sector is not evidence-based.

A paradigm shift is required in policy-making to a solutions-led approach that results in public and private policies targeting solutions for a healthier Canada combining human, environmental and societal benefits.

FOREWARD

“Saskatchewan isn’t fit for man nor beast”

Moses Beeston - 1912

In my professional career, I have worked in Canada with both the public and private sectors in the food and industrial agriculture systems with significant emphasis on health and wellness. The latter segment is commonly referred to in Canada as the functional food and natural health products’ (FFNHP) sector. It is my experience that actors operating within this segment believe innovation to be the very foundation of its development. Numerous provincial and federal government initiatives and programs have been developed and implemented with the goal of supporting the growth of the segment.

The literature indicates however that the general concept of innovation is not well understood. If that is true, then policies that have been developed in Canada targeting this segment may not have the desired impact. The research explores the concept of innovation as it applies to the Canadian FFNHP segment and therefore adds new knowledge – and contributes to the on-going debate – of this concept of innovation and the policies that support innovation. The research also contributes to the foundation of evidence required for the policy-making process as it relates to innovation.

Personal introduction

In the early 1900s, one of the goals of the Department of the Interior in Canada was to populate the country’s western frontier. Immigrant farmers and agricultural workers were attracted by the hope of ‘free land’ in the form of land grants in return for backbreaking labour. These immigrants were promised property rights if they cleared and cultivated land each year for three years.

My great uncle, Moses Beeston, took up the challenge. Having obtained a Homestead Entry by the Department of the Interior, he immigrated to Canada from Manchester, England and settled in Richlea, Saskatchewan (which no longer exists). Upon arrival, he wrote to his three brothers and their families to join him. It was no mean feat in those days. My grandfather and his other two brothers spent the next three years securing the money required for steerage passage to the new world for themselves and their families.

During that time, Moses cleared and cultivated thirty-five acres of land in Saskatchewan. Upon being given clear title to the property in 1912, he immediately sold it and met his brothers and their families in Toronto as they were preparing to head west. My father was a very young boy at the time and was part of the family contingent that emigrated from England to his new home in Canada. As my father recounted on several occasions, Moses warned that *"Saskatchewan isn't fit for man nor beast".* Who would dare refute anyone whose name is Moses?

Moses like many other immigrants to western Canada found the prairies to be harsh. There were few neighbours resulting in immense loneliness; massive weather extremes (forty degrees below in the winter and forty degrees above in the summer); and farming that demanded considerably different agricultural skills and technology than the much smaller farms in England to which he was accustomed.

And so, the Beeston clan settled in southern Ontario where Moses and Jabez (my grandfather) found jobs in the rail yards of Toronto. My parents eventually settled in Welland, Ontario where I grew up. My sister, brothers and I therefore viewed life amid the densely populated area of the Niagara Peninsula – the 'banana belt' of Canada (given its name for the milder weather in the area than most other regions of Canada; or by the shape of the fertile agriculture growing area that surrounds Lake Ontario – both scenarios appear to have risen from folklore that have gained credibility with area residents).

Food was plentiful at the store. And while books all claimed that food was somehow related to farming, our reality was that food either came from a dairy, the bakery, the meat market or the Dominion store. Our limited direct knowledge of farms was driving past the plentiful fruit orchards (apples, cherries, pears, peaches) on one of our periodic ninety-minute trips to Toronto. We were no different than our school chums who just assumed food miraculously appeared if you had the money to buy it.

Life is often filled with irony. As a descendant of the clan who rebuffed the prairies and a life in agriculture, I found myself several years later, raising a family of my own right in the heart of Canada's 'bread basket' – Saskatchewan, the province that left my great uncle with such harsh feelings – a place that I came to love. I spent twenty-six years in that province becoming enmeshed within the food system albeit at a different stage than Uncle Moses. I often wonder what he would have thought of my diametrically opposed view of the province.

The winds of change

While the weather remains harsh, Saskatchewan, as well as the rest of the Canadian prairies, has blossomed into a province that celebrates its agricultural roots. As new markets for value-added[1] agricultural and food products were opening up domestically and abroad, value chains were being formed and agriculture was becoming big business. 'Sidewalk farmers' (farmers who live in the city and commute to their land) were becoming the norm. Most Saskatchewanians believed that the annual provincial economy was solely dependent on the plight of the farming community discounting the immense contribution of the uranium, potash and oil and gas sectors to the provincial economy. Provincial and federal governments were providing increasing support for research and development into value-added agricultural activity.

I graduated from the University of Saskatchewan into this environment with a Masters Degree in Business Administration in 1991. I found my niche consulting to the agricultural and food sector working with government departments, universities, industry associations, producer co-operatives, and businesses across the prairies. And while the demographic make-up of my clientele remained relatively unchanged over the years, attention was being drawn to the newly called 'bio-based' industry.

While support for primary agriculture was still prevalent, there appeared to be a shift in the late 1990s on 'coffee row', at the universities and research institutes, in companies and within the government towards assessing the opportunities for science based products such as functional foods, natural health products and industrial bioproducts including biofuels.

The agricultural industry familiar to Moses Beeston and other immigrants in the early 1900s where primary agricultural products were grown and eventually sold to homemakers to turn into a family meal had changed considerably. My clients were discussing innovation, product attributes, packaging, technology, niche markets, health benefits, the environment, commercialization, brand positioning, government regulations, collaboration with producer co-operatives in Mexico – concepts that would have made the minds of Moses and his fellow homesteaders spin.

[1] Value-added agriculture ranges from primary activities such as cleaning and bagging commodities to tertiary activities where components of agricultural products are extracted for both food and non food uses.

The support sector was also changing to address these new approaches. Collaborations in the consulting field were becoming a necessity to address the increasingly complex challenges of the industry. As a result, I found my network and my clientele expanding nationally and internationally. Over the years, I have teamed with nutritionists, aquaculturalists, scientists, agronomists, chemists, market analysts, communications' experts, all to bring value to clients. My projects have taken me to far reaching destinations such as Australia, Kyrgyzstan, Bulgaria, Britain, Ireland, Malaysia, Singapore and The Philippines.

My experience has been that regardless of the country, the company or government, the major focus for the agriculture and food sector appears to be a quest to finding a magic bullet – the pathway – that will result in economic benefit within a very short period of time. Government programs emphasize the need to 'make the business case' for investment into certain sectors or infrastructure with economic outcomes most often the only criterion considered.

By 1998, my work was taking me in the direction of the health and wellness segment (functional food and natural health products) of the sector and to a lesser extent industrial bioproducts. Universities were attempting to determine if technologies developed or bioactives identified by their researchers and targeted at this segment had market value. More companies in this segment were springing up throughout Western Canada. Industry associations such as the Saskatchewan Nutraceutical Network and the British Columbia Functional Food and Natural Health Products Network were being formed to support the growth of the segment. Commodity-specific, agricultural organizations (e.g. canola, flax, sunflower, pulses, etc.) were attempting to identify attributes of their crops that would result in increased health if consumed or used – health for the population and/or health for the environment. The system stakeholders were all looking for an answer as to whether there was a sustainable market for these types of products.

Challenges in the food economy

I found myself increasingly undertaking projects to examine that question for specific products and ingredients. And it was challenging. My clients were finding it difficult to attract both public and private investment. The length of time from idea to market for these science based companies was far beyond that of the box within which angel or venture capital funds operate. Government departments also claimed the need to 'show results' to the keepers of the public purse within a shorter time frame than was

possible in this segment of the food system. The hue and cry about the health of the nation and the environment was only beginning to spread beyond the voices of the informed few. And the strength in the rank and file of primary producers, and the influence of their producer organizations, was still a major consideration at the ballot box.

It was during that time that the federal and provincial governments began to take more than a superficial interest in the segment. In 2001-02, I was commissioned by a federal government organization to meet with industry stakeholders whose activities were focused at the development of health and wellness products (functional food and natural health products). I conducted focus groups with principals of small and medium sized enterprises (SMEs) and interviewed representatives from large and multinational enterprises. The goal was to identify challenges and opportunities for the Western Canadian segment to capture sustainable markets and to seek input into activities that could be undertaken by the department to assist in the development of the segment.

The study was used as evidence to establish Wellness West (WW). WW is a collaborative agreement among nine government departments – seven departments within the four Western Canadian provincial governments (British Columbia, Alberta, Saskatchewan and Manitoba) as well as the federal agencies, the National Research Council and Western Economic Development. In addition, WW formed a working relationship with Agriculture and Agri-Food Canada. The focus of the government collaboration has been to assist the development of the functional food and natural health products' segment of Western Canada. I have worked with the group over the years in a facilitative role.

Through that specific initiative and my other work, my interest in and commitment to the FFNHP segment has grown over the years. But I began questioning how and indeed whether Canada could compete in this global sector. Then Prime Minister Paul Martin continually espoused during his lengthy campaign for the job and during his tenure (PM from December 2003 to February 2006) the need for Canada to become knowledge-based and innovative. In fact, these words have become the buzz words for industry, universities, nongovernment organizations and governments alike in Canada.

But what is innovation? What does it take to be innovative in the science-based food system? Does Canada (and particularly its FFNHP segment) have what it takes to be innovative? What is Canada's role in the new global agriculture and food system? What are the roles of the various stakeholders in building new sectors of the economy? What factors should governments consider in a 'business case' when considering investment into a knowledge sector? What government policies should be put in place to enable the development of a knowledge-based industry? And how should the success of these policies be measured? Given the new reality of the strength of global agri- business, what can Canadian SMEs actually hope to achieve? And how can Canada capture the benefit of the science-based food segment not only from an economic perspective but also from a population and environmental health perspective? What other benefits can Canada hope to derive if this segment is proven to be sustainable? And how can this segment in Canada make a positive contribution globally?

While the scope of the research cannot explore all areas, the major questions remain of interest.

The educational direction forward

If the concept of innovation is not understood, innovation policy will not be effective. To bring focus to the research to prove or disprove the hypothesis, a segment of the Canadian food system, the functional food and natural health products' segment is examined utilizing the case study method. This segment was chosen as it claims innovation as its foundation and yet Herath et al. found there has been little research to understand innovation in the functional food and natural health product sector (Herath et al. 2010).

The Canadian segment is comprised of small and medium sized enterprises and therefore findings of the research should be of interest to countries that are similar in nature. From a policy perspective, Canadian decision-makers are seeking to establish the country as innovative and knowledge-based as its competitive advantage. And similar to other countries, Canada is struggling to maintain a treatment based health care system. Health prevention is increasingly being promoted by all actors.

It is within this environment, linking food and nutrition to preventative health, that innovation and federal policy is investigated. The scope of the research examines

the concept of innovation; the drivers of innovation; the current level of innovation in Canada's functional food and natural health products' (FFNHP) segment; and the policy environment in Canada within which the segment operates. The goal of the research is to provide evidence that will inform policy-making based on a critical review of the literature and an analysis of primary research.

Qualitative research methods were utilized in the primary research. Approximately forty elite interviews were conducted targeting the actor groups of innovation: industry, government, academia/research and civil society (as represented by non government organizations).

The dissertation is comprised of four major parts: 1) Chapters One and Two, the literature review; 2) Chapter Three, methodology; 3) Chapters Four, Five, Six and Seven, findings and critical analysis of the primary research; and 4) Chapter Eight, personal reflections.

Chapters One and Two set the context within which the primary research is examined. Chapter One explores the food system, innovation and policy. The chapter argues the food system, within which the FFNHP segment operates, is best characterised as being comprised of demand networks rather than supply chains. This shift is proving challenging for SMEs to penetrate. Innovation is deemed therefore by this group as the pathway to market success. A critical analysis of the literature reveals that there is no common understanding of the concept of innovation. Policy however does not stand still. Policy continues to be implemented that aims to support the concept of innovation. An analysis of policy, particularly as it applies to the food system and innovation is examined.

Chapter Two begins the process of narrowing the scope of the research. It reviews the literature in the areas covered in the previous chapter but as it applies to Canada. It argues that Canadian policies as they apply to the food system are focused predominantly on primary production. It also argues that policies targeting innovation are being compromised by actions taken by the government.

Chapter Three outlines the methodology upon which the primary research or field work was undertaken. The elite, active interview approach enabled the experience and insight of the interviewees to gain a better understanding of the concept of innovation and the policy-making process in Canada. Forty interviews were

conducted during the field work with industry, government, research/academia and nongovernment organizations. Within the actor group of government, one politician and five federal public servants were interviewed. Note that the term public servant rather than civil servant is used in Canada.

Chapters Four, Five and Six describe the findings of the interviews while Chapter Seven conducts a critical analysis of the findings in combination with the literature review. The analysis of the primary and secondary research demonstrates that context-based, evidence-based policy-making is not occurring in Canada at least with respect to innovation and the high-value added food sector. Knowledge, collaboration and dialogue, foundations of policy-making, with and among actor groups are not occurring particularly within government. Policies are being developed in silos even within departments.

The research however added new knowledge to the concept of innovation. It argues that the human elements of imagination and insight must be added to the formal multi-dimensional definition of innovation to acknowledge their importance and key role they play. This new knowledge has policy implications with respect to building knowledge capacity in the country. Research however is required to gain a better understanding of these human elements in innovation and the implications of it on policy. Chapter Seven also argues for a solutions-led approach to policy-making with respect to human, environmental and societal health.

Chapter Eight offers personal observations and opinions regarding the research process and future research. It argues that while the policy framework in Canada does not enable innovation, and it even inhibits innovation, innovation will not stop. The nature of the phenomenon, the human element will not it allow it to stop.

CHAPTER ONE - Thesis framework: the agri-food system, innovation and policy

"Food has emerged as a political topic par excellence" – Marianne E. Lien (Lien 2004b) p.1

1. 0 INTRODUCTION

This chapter provides the overview of the framework to assess the innovation policy environment. The framework includes an analysis of the food system, innovation, and policy as it relates to the food system and innovation.

The chapter presents three core arguments based on a critical analysis of the literature. The first is that food system supply chains are better described as demand networks, characterized by a new generation of products, technologies and power structures influenced and or controlled by international actors or non traditional actors at the consumption end of the spectrum rather than at the production end. The implication is that policy issues are more complex requiring policies that are multi-dimensional. As well, those policies attempting to provide benefit locally or nationally may be realized elsewhere.

The second core argument is that the concept of innovation still lacks agreement in academic literature. While the debate regarding the meaning of it has intensified in the last couple of decades, there is still no agreement on its meaning. This chapter demonstrates that regardless of the meaning, governments and industries alike have elevated the importance of innovation to one that provides the competitive advantage from an economic perspective. The literature also demonstrates an emerging recognition of measurements such as providing societal and environmental benefit.

Academic debate focuses on two lines of thought: innovation as an outcome and innovation as a system that creates knowledge. The policy implication is where investment is made. If innovation is an outcome (e.g. new product, service, process, technology) then public policy is likely to focus on supporting downstream commercialization. If innovation is a

system that creates new knowledge, then policy is likely to support basic research. The question is whether the two theories are mutually exclusive.

The third core argument of this chapter is that policy-making cannot be based on evidence alone. Policy areas and policy-makers are influenced by internal and external variables. To ensure that these variables are understood, dialogue among and within actor groups is critical to reduce the risk of policy failure.

1.1 Theoretical positions on the agri-food system

Food is a sustenance with which every person in the world identifies. People however have different views of what food represents. It can be viewed as a reward, a tool for communication, a celebration, a religious symbol, a weapon in warfare, energy, a crutch, or for too many people in this world, sustenance to live until the next day. While everyone perceives food differently, the common thread is that food is consumed – taken internally. Thus people have formed a relationship with this commodity, one unlike any other commodity. Winson thus refers to food as *"the intimate commodity"* (the title of his 1993 book) (Winson 1993), a commodity that moves through a food system to meet the needs of various end users.

There appears to be two distinct lines of thinking in the general definition of a food system. The first is a more economic or business viewpoint, consistent with a description of a supply chain (Armstrong et al. 2005). Applying that approach, the food system examines how food products derived from agricultural, marine and other biological and natural resources move through the various channels of production and distribution to the end user. This concept also includes inputs such as fertilizers, equipment and packaging, and outputs such as environmental waste (Yakovleva & Flynn 2004). Based on that description, the terms supply chain and food system are used interchangeably.

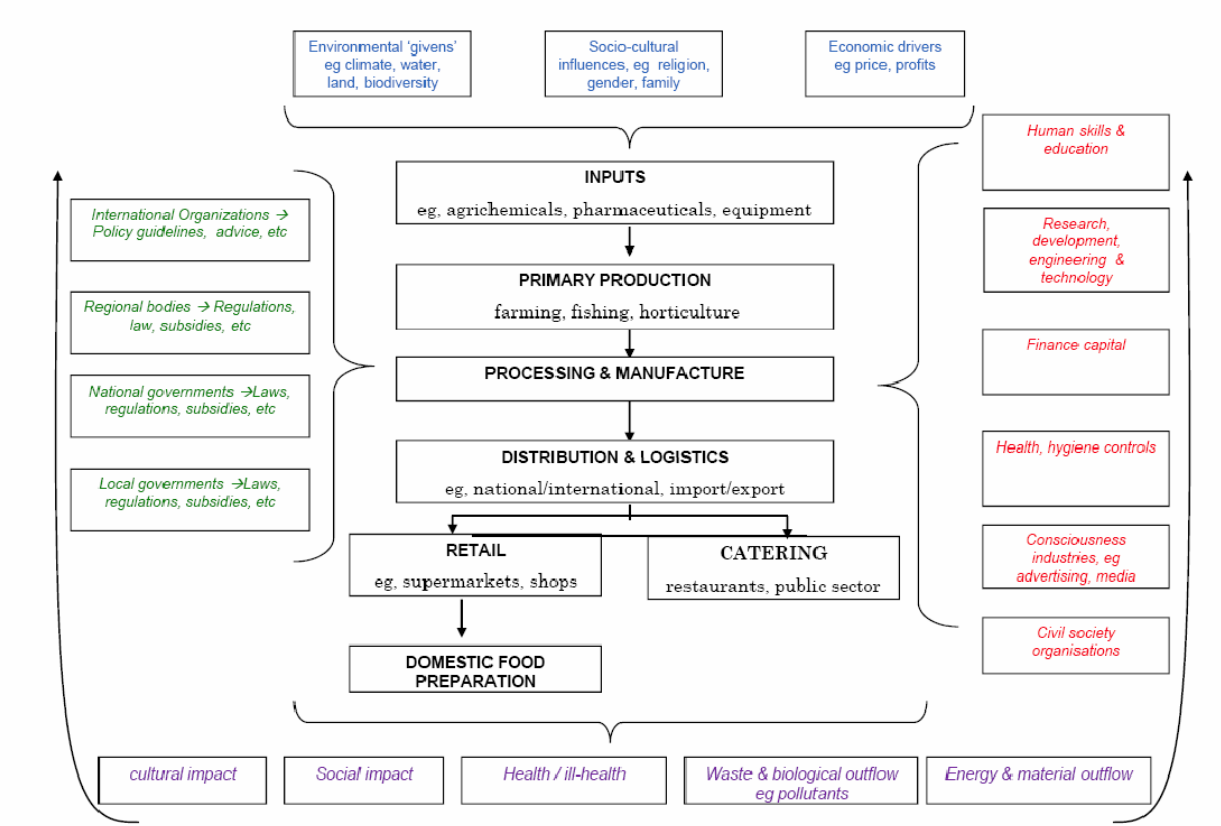
A broader view of a food system however not only entails the examination of food production to food consumption but also the rationale for consumption choices (Tansey & Worsley 2004). In other words, the

supporters of this line of thinking perceive the concept of a supply chain as being somewhat linear but only one component of a food system.

Lang offers a more holistic view of the food system. His schematic as presented on the following page provides insight into a food system that is comprised not simply of production and consumption which is consistent with equating the food system with a supply chain. Lang's multi-dimensional food system also includes factors that influence the production and consumption functions: governance, indirect inputs and resources, drivers and outcomes of the system (Lang 2010b).

Tansey and Worsley provide measures to a successful food system by offering their criteria of what constitutes a good food system: *"Is it safe? Is it sufficient? Does it enhance food security? Is it sustainable? Does it promote a nutritious diet? Does it enable all to meet their food needs?"* (Tansey & Worsley 1995) p. 5.

Figure 1: The food system, its external influences and outflow: a schema



Source: Lang 2010b

1.1.1 What is a food supply chain?

Supply chains have evolved over time. The supply chain is of critical importance to the success of any company. In some cases, supply chains are a study of logistics reflecting simply the movement of consumer ready products to the market (Markillie 2006).

The term value chain is also utilized interchangeably in the literature with the supply chain. Hobbs describes the supply chain of the functional food and nutraceutical sector (Hobbs 2002) while Sankaran quotes extensively from Hobbs' work but refers to a value chain (Sankaran 2005) rather than supply chain.

Ponte and Gibbon also refer to value chains. They argue that value-chains have evolved into being buyer driven but also that the focus is on quality standards, often beyond that demanded by specific government agencies (Ponte & Gibbon 2005). Quality is defined differently by various chains. In some instances, quality equates to food safety while in others it refers to organic, fair trade or other perceived quality or value benefit.

A value chain has also been referred to as the dispersion of production (International Trade Canada 2006; Robinson 2006) consistent with the interpretation of a supply chain as a study in logistics. Porter, and Lang and Heasman offer a broader version of the concept by referring to value being added to primary products as they move through the various channels to the market (Lang & Heasman 2005; Porter 1985). The change occurs as a commodity progresses through the various channels with the goal of differentiating the product in the eyes of the various actors (Friedland 2005) and provide a competitive advantage to the company (Porter 1985).

Le Heron concurs by arguing that food no longer focuses on production but rather on adding value. He extends his argument by observing that value is predominantly added within regions or continents rather than globally. The impact is that cross-continental chains are being forged. He argues that the impact is competition occurring between chains rather than specific actors in various chains (Le Heron 2005). Other authors concur with LeHeron. Case studies of tomato processing and potato supply chains

indicate that while there is a global nature to those supply chains, trade is conducted primarily within regions and thus within a continent (Pritchard & Burch 2003; Yakovleva & Flynn 2004).

With respect to supply chain competition, Markillie came to the same conclusion. He argues that the supply chains of the future will be in competition with each other rather than between like channel members (Markillie 2006).

There is support for viewing the current chains as value rather than supply due to the numerous and sometimes complex relationships forged along that pathway to the market (Friedmann & McMichael 1989; Pritchard & Burch 2003; Sankaran 2005; Yakovleva & Flynn 2004). From a demand perspective, more value is being added beyond the farm gate to meet the growing consumer demand for food services and home meal replacements (HMR). Companies adding value beyond the farm gate have enjoyed higher returns than the primary producers (Pritchard & Burch 2003).

The concept of the term chain also appears to be transitioning into new terminology. The term 'network' is being substituted for 'chain' due to increasing complexities along the value chain. Non traditional actors are participating in cross functional teams and alliances to deliver new products to the market. Tate and Lyle for example, the British ingredient company, works with other channel members to develop new products (Schmeltzer 2006).

Other large food manufacturers as well are participating in alliances. To fend off the growing strength of the retail sector, food manufacturers are forming alliances with pharmaceutical companies and thereby repositioning themselves under the banner of health and wellness. (Lawrence & Burch 2008). These complexities have resulted in alternative terminology for 'chain' or references to a 'network' or 'networks'. The interest in networks has been heightened by scientific and technical activities that translate discovery or basic science into technical and profitable innovations (Freeman & Louca 2001).

Networks are often considered in the social context of developing personal relationships and exchanging information on either a formal or informal basis utilizing technology or in-person contact (open source 2006). The age of rapid communication also has heightened the use of the term network.

Castells draws attention however to the growth of networks in the business context, not just the social context. He argues that there has been a growth in horizontal networking or interfirm networks among small and medium sized enterprises (SME). These network initiatives are no longer relegated to one company meeting the demands of one large corporation. A transition to networks has occurred. While a large company may contract with one or more SMEs for various production and technology initiatives, the SMEs themselves are joining together in other relationships and networks to fill market niches with other products (Castells 1996).

A subset of an interfirm network is the strategic alliance or joint venture (Castells 1996). An example of this form of network is the Solae Company, a joint venture between DuPont and Bunge. DuPont offered its research and branding capabilities and Bunge its capabilities in processing (Hodgins et al. 2004) to produce and market a soy isolate ingredient.

Castells speaks of the new type of enterprise that has emerged – the network enterprise. *"Networks are the fundamental stuff of which new organizations are and will be made. And they are able to form and expand all over the main streets and back alleys of the global economy because of their reliance on the information power provided by the new technological paradigm"* (Castells 1996) p.171. In other words, Castells argues that these new network enterprises form nodes with various organizations when their goals for specific initiatives (new products, technology development, market entry, etc.) are consistent with one another.

Castells also argues that networks provide a suitable model for industries whose markets are based on innovation, globalization and decentralized concentration (Castells 1996). Jones et al. take Castells point further by noting that networks are not only suitable models, they are key in

developing and bringing new technologies to the market (Jones et al. 2001).

There is no doubt that the supply/value chain has become more complex. Four cases were reviewed to examine similarities, trends, and differences. The first one is the examination of the United Kingdom potato supply chain (Yakovleva & Flynn 2004); the second, the tomato processing industry (Pritchard & Burch 2003); the third, the nutraceutical[2] and functional food industry (Hobbs 2002); and lastly, the nutraceutical industry for a marine-based product (Sankaran 2005). All four studies spoke to the complexities of the supply chain and the various networks that were critical to the success of their specific supply or value chain.

1.1.2 The food network

Yakovleva and Flynn refer to the network known as the food supply chain that facilitates the production and movement of goods and services to consumers. They argue that both economic and social relationships are encompassed in the concept of the network of organizations that facilitate the production of goods and services (Yakovleva & Flynn 2004).

Hobbs as well speaks to the complex nature of supply chains which are comprised of multiple networks. She notes that in Canada, many networks exist with multiple relationships at all stages of the chain. Complexity exists due to the very nature of the functions undertaken, participants involved and their relationships. Specifically Hobbs refers to the functional food and nutraceutical sector. Functions within that sector follow the commercialization pathway from idea/basic research/discovery and development to commercialization and marketing of the products. Hobbs observed that activities along that pathway are often complex. They can be completed within a company or more often than not, accomplished through

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[2] In Canada, the term 'nutraceutical' is encompassed in the legal definition of a Natural Health Product (NHP) which came into affect on January 1, 2004 under the Natural Health Products Regulations as set out by Health Canada. According to the Regulations, NHPs *"are defined as vitamins and minerals, herbal remedies, homeopathic medicines, traditional medicines such as traditional Chinese medicines, probiotics, and other products like amino acids and essential fatty acids. NHPs must be safe for consideration as over-the-counter products, be available for self-care and self-selection and not require a prescription to be sold"*.

various relationships. The determination of the pathway is based on internal capacity and core competencies of the company. Hobbs argues therefore that a supply chain should not be considered linear (Hobbs 2002) which supports the concept of a network.

Sankaran supports that view. He conducted a study of the development of Lyprinol, a New Zealand developed marine-based natural health product by MacLab NZ. Lyprinol's biological source is green lipped mussel native to New Zealand. It is marketed by Australian-based Pharmalink Marketing Services Pty Ltd.

Sankaran argues that the expanse of the network(s) depends on the life cycle of the company. New companies are more apt to engage in a wider network of collaborations than established companies introducing a new product or second generation product. Sankaran believes that the need for evidence-based claims makes this sector (nutraceutical) of the food industry unique and interesting but results in a much longer timeframe to get the product to the market (Sankaran 2005).

Sankaran suggests that three major strategies are required to commercialize a nutraceutical: 1) the development of the intellectual or proprietary property; 2) the clinical studies to prove the health claims; and 3) brand/market development. Each strategy requires an interconnecting network of actors for implementation purposes. Sankaran concurs with Hobbs that start up companies are more apt to form collaborations and thus have a wider network than established companies (Sankaran 2005).

Sankaran adds to the discussion by exploring the issue of knowledge networking within a supply chain focusing on innovation which he argues marks the functional food natural health product / nutraceutical segment of the industry. He notes that collaborations among research entities in the chain may be changed several times in the product development process in order to access the expertise of various actors with the goal of creating new knowledge (Sankaran 2005).

The various cases reveal a complex web of actors that exist in the food system. They include among other general categories the financial

community, research institutions from different sectors, policy-making bodies, industry associations, farm input companies, primary and secondary producers, processors, SMEs and multinational enterprises (MNE), distribution organizations, retailers, foodservice outlets, buyers, highly qualified personnel with technical know-how and ideas (HPQ), consumers, consumer organizations and activist groups or the *"third sector"* (The Economist 2006) p.63, a term utilized by Prime Minister Tony Blair to describe the growing influence and participation of non government organizations (NGOs). Steward also notes this complex web by referring to it as *"institutional diversity"* (Steward 2001) p.194. The diverse nature of the food system he argues increases the difficulties in examining it.

In applied terms, HSBC – one of the largest global financial services' firm – no longer discusses the 'supply chain'. Rather the bank speaks to the notion of a 'supply network' based on the new global reality of sourcing inputs and undertaking manufacturing activities in other parts of the globe (Papadotos 2005).

It therefore is more appropriate to refer to a network rather than a chain. Chains are linear (Hobbs 2002; Tansey & Worsley 2004) and do not capture the evolved, complex nature of what is commonly termed the supply or value chain.

With respect to 'supply' in supply chain, Engelbart and Rijswijk argue that a shift has occurred in what he terms *"chain reversals"*. They studied the European floriculture industry and concluded that the consumer is now pulling the product – cut flowers, through the various channels rather the flowers being pushed through the system by the suppliers. In other words, the buyer was identified as the main driver of the chain, demanding the product (Engelbart and Rijswijk 2001).

There is no doubt that consumers and consumer activism have forced changes in the supply chain. The aversion to genetically modified (GM) food in Europe forced companies to identify the presence of GM organisms in food products. In addition, consumer reaction is responsible for the increasing number of fair-trade product offerings on the market (Fletcher 2006; Gabriel & Lang 2006). Gabriel and Lang argue however that

consumer activism has not resulted in power in the marketplace but rather in the public relations offices of multinational companies. Even so, an increasing number of international companies have made commitments to the fair-trade movement in response to growing consumer recognition of social issues particularly in emerging nations. Marks and Spencer for example vowed to increase its commitment to source fair-trade cotton items and food/beverage products, a measure that will certainly affect its supply chain (Rose 2006).

The third food regime, while not attributing power to consumers, recognizes that power is shifting along the various food channels to the buyers, only one degree of separation from consumers (Burch & Lawrence 2005).

The conclusion therefore is that a supply or value chain has evolved and is better described as a demand network.

1.1.3 Challenges for the new demand networks

The case studies highlight two differentiating features between the now termed demand networks of the tomato processing and potato sectors, and the high value added nutraceutical sector: the environment of uncertainty and the time frame to market.

The environment of uncertainty revolves around the regulatory environment as well as market acceptance. Regulatory environments in various countries are currently being established and are evolving. Essentially, the products/technologies as well as the markets are unproven (Hobbs 2002). The uncertainty results in the necessity of understanding and managing the inherent risk in such a venture (Barling & Lang 2005a; Sankaran 2005). The potato and tomato processing sectors have market acceptance and therefore innovation is focused on securing a competitive advantage in a highly competitive market (Pritchard & Burch 2003; Yakovleva & Flynn 2004).

The other differentiating aspect to these demand networks is the time frame to commercialize a product. While new packaging, processing equipment or new varieties of crops can take up to five or more years to develop and produce, the base product (e.g. tomato paste) remains on the market

(Pritchard & Burch 2003) providing much needed revenue and an established consumer base for new products. The average length of time from idea to market for a highly innovative product such as a nutraceutical or technology however is now averaging thirteen years, an increase of three years since 2000 (Dr. Howard Tennant – Council Member of the National Research Council of Canada and President Emeritus of the University of Lethbridge).

In addition, the issue of a food system may be better perceived as a set of agricultural and agri-food systems – rather than just one system. The nature of demand networks indicates the complex nature of multiple networks at work. As well, agriculture is no longer only about food. As more attention is being paid to new uses for the entire plant, marine or animal such as for energy, biocomposites, biomaterials, the term food system no longer seems adequate. The 'food system' therefore should be plural in nature and include acknowledgement of non food uses.

1.1.4 The drivers

As discussed previously, the power in the demand network has clearly passed to the retailers as they have focused on increasing efficiencies throughout the demand network (Yakovleva & Flynn 2004). But what has enabled the current stranglehold on the industry by the retailers? A review of the literature including the four case studies identified in the previous section indicates that the major drivers enabling the power transition have been: consolidation throughout the industry, particularly at the retailer level; technology development; globalization; health of people and the environment; and quirky consumers.

Consolidation

Consolidation has occurred throughout the food industry particularly at the food retail sector with the aim of reducing costs in the supply chain/demand network (Department of Environment Food and Rural Affairs (UK) 2005; Lang & Heasman 2005) by looking for the lowest cost source (Coleman et al. 2004; Klein 2000). The consolidation has resulted in significant purchasing power (Burch & Lawrence 2005; Friedmann and McMichael 1989) as well as the growth of private or own label products at the large retail channel (Lawrence & Burch 2008).

Retailers are using private labelling to solidify their strength in the marketplace. The 2005 global rate for store branded products was twenty-one percent but is expected to reach thirty percent by 2020 (Olson 2005). The estimate could in fact be much higher due to strong consumer acceptance of private brands. Results of the survey conducted by ACNeilsen concluded that two-thirds of global consumers perceive private label products as good alternatives to branded products (AC Nielsen 2005).

Consolidation has occurred as well at the primary production end of the spectrum. While small family farms are expected to continue, consolidation will continue as large farms continue to expand at the expense of the medium sized farms (Bonanno 1987; Lowe & Gereffi 2009).

Consolidation however is not universal. It can vary by region such as in the tomato processing sector. Pritchard and Burch note that the North American consolidation of that sector has resulted in the survival of only a few large branded operations while the European sector is still in the hands of a plethora of companies. Consequently, the North American sector realizes lower costs of production than its European counterpart. (Pritchard & Burch 2003).

Technology

A technological revolution particularly in information technology (Castells 1996) is changing the way organizations operate. The advent of the internet for example has forever changed the demand network. By using that technology to support many functional areas such as logistics, companies have been able to respond more quickly to market demand. Continued pressure will increase to ensure the networks are more responsive to consumer demand. By doing so, the risk to both the retailer and manufacturer will be reduced by minimizing the amount of inventory carried (Markillie 2006).

Wal-Mart provides a classic example of how technology has been utilized to increase efficiencies (Friedman 2005; Markillie 2006) and provide cheap goods to a myriad of customers around the world. Wal-Mart moved over two billion containers of goods between 2004 and 2005 to its stores in

fourteen countries (Friedman 2005). Now the company looks to a new technology, radio frequency identification (RFID), to ensure that it is aware of the exact location of each of its cartons and the contents. Wal-Mart's focus on efficiencies through the demand network has assisted it to become the largest, global retailer of groceries reaching sales of USD $244.5 billion in 2004 (Hendrickson & Heffernan 2005) increasing to $401.2 billion USD in 2008 (Painter 2009).

The use of technology is not limited to the Wal-Marts of the world. To increase flexibility and be first to market, Clearwater Seafood Limited Partnership of Nova Scotia, Canada has incorporated UPS and its carriers into its demand network. The company ships live Nova Scotia lobsters directly to the UPS Worldport Hub (distribution hub) in Kentucky, U.S. where they are cared for and sent as needed around the world in response to instant communication between the buyer and seller utilizing the internet (Markillie 2006).

Risk reduction by operating a lean inventory in an industry that is marked by low margins (lower margins than in many other industries) also poses challenges if crises or unplanned events are not considered (Markillie 2006). In May 2006, Pacific Blends Ltd. of Port Coquitlam, British Columbia was forced to shut down full production of its surimi line when its shipment of Alaskan Pollack, the major input into surimi (minced fish), was left on a ship in Vancouver harbour unable to dock due to high winds. The company's loss in production was significant.

In addition to the use of information technology to increase efficiencies, technology is utilized to produce new and innovative consumer products and packaging in response to consumer demands for more choice in processed products (Newton 2000; Yakovleva & Flynn 2004). New product development impacts other actors in the demand network. Yakovleva & Flynn note that the development of a new type of crisp (known in North America as potato chips) could impact the farming community as different or new varieties are required (Yakovleva & Flynn 2004). That new variety may not be locally available or grow well near to its manufacturing plant.

New technologies are leading to the development of a multitude of new food products. Extraction technologies for example, allow scientists to extract nutrients from biological compounds to add them to food products offering added health benefits. Nanotechnology is also resulting in new foods. Utilizing nanotechnology, scientists have developed low and fat-free foods that are similar in taste to the full fat option (e.g. ice-cream). The demand is increasing for use of the technology in food. *"The global market for nanotechnology in food was $140 million in 2006 and is expected to balloon to $5.6 billion in 2012"* (Kelland 2010) p.B8.

Concerns have been expressed however about new technologies such as nanotechnology. One concern is that the longer term implication of the consumption of products utilizing nanotechnology on human health has not yet been fully understood and requires more research (Lawrence & Burch 2008).

Kelland argues another challenge regarding the introduction of new technologies will be consumer acceptance. The European negative reaction to genetically modified foods for example demonstrated that new technology does not always translate into market success for new food products (Kelland 2010).

New technology or not, the market for new food products continues to flourish. Mintel, the market intelligence company that tracks the food industry, adds approximately twenty thousand new products monthly based on its continual scan of forty-nine of the world's major economies (Mintel 2010).

It is interesting to note that there appears to be no data on the number of product withdrawals from the market although there is disagreement as to the number of new products that fail. Baldwin estimates however that approximately ninety percent of all new products across all consumer product categories fail within two years of market entry (Baldwin 2006). With respect to the global food and drink industry, the failure rate is estimated to be at that level. While Lewis notes that the percentage appears to be high, she argues the critical point is that there is tremendous

risk in developing and introducing new food and drink products into the global marketplace (Lewis 2008).

Globalization

Globalization is not a new concept but has evolved over time (Baber 2005; Fold & Pritchard 2005; Friedland 2005). Similar to the discussion regarding the definitions of food systems versus supply chains versus value chains versus demand networks, the definition of globalization is also open for discussion.

There appears to be consensus that globalization is a process (Friedland 2005; Held et al. 1999) and as such is and will be ever changing (Held et al. 1999; Pritchard and Burch 2003). Globalization is also about social and economic networks, relationships and power across and within continents (Held et al. 1999). However globalization is most often referred to in economic terms (Klein 2002) as the political or social terms have not been nurtured to the same extent or are ignored completely. The result is that globalization is now driven by multinational corporations (Stiglitz 2002; Zamagni 2005). Zamagni argues that this focus has created winners and losers and impacted on the social values which determines a country's identity (Zamagni 2005).

Goodman dissects the definition of globalization further. He argues that globalization is often considered the same as, but in fact is different than, internationalization, transnationalization and multinationalization. Goodman argues that globalization differentiates itself from the other concepts by including the key characteristic of networks of innovation and production undertaken between and among organizations in varying locations throughout the world (Goodman 1997). Klein concurs with this interpretation (Klein 2002).

With respect to globalization and the agri-food system, Friedland speaks of production and consumption through space and time (Friedland 2005; Pritchard & Burch 2003) so that consumer demand can be met on a year round basis (Department of Environment Food and Rural Affairs (UK) 2005; Friedland 2005; Lawrence 2004). The result is that commodity production

moves between north and south during the year depending on the growing cycle.

Goodman also speaks of globalization in terms of flexibility of capital or the global mobility of finances which has affected the global agri-food industry significantly (Goodman 1997). This factor has far reaching concerns as investors now look not only at multiple opportunities within this sector for investment but other industries with competing interests as well that may offer higher returns (Pritchard & Burch 2003). In other words, agri-food companies and networks not only compete with each other in attracting investment but with other industries as well. This argument is linked with the Boston Consulting Group's concept of globality which is based on economic outcomes resulting from *"competing with everyone, from everywhere, for everything"* (Sirkin et al. 2008) p.1. The concept of globality however recognizes the new challenges of the speed of change caused by various drivers of globalization and puts forward the premise that decisions often must be made rapidly. Interestingly though the concept also maintains that sustainability and social responsibility factors must be predominant considerations in economic outcomes.

Fold, Burch and Pritchard offer a different view with respect to globalization and the food system. They argue that the food system for the most part is cross-continental rather than global in nature (Fold & Pritchard 2005; Pritchard & Burch 2003). Pritchard and Burch through an examination of the tomato industry demonstrate that there is no global model. They argue that production and consumption are in fact happening more on a national or regional basis (Pritchard & Burch 2003). They observe that global trade and systems in relation to the agri-food system are still in the experimental stages. Fold and Pritchard provide credence to that assertion by noting that cross-continental trade rather than trans-continental trade was responsible for sixty percent of additional trade in food during the 1990s (Fold & Pritchard 2005).

The increased cross-continental trade is likely the result of the increased number of regional trade agreements that occurred in the 1990s and early 2000s. Between 1948 and 1994, the General Agreement on Tariffs and Trade (GATT) reported one hundred and twenty-four regional agreements

in the world. Since 1995, the World Trade Organization (WTO), successor to the GATT, identifies an additional one hundred and thirty such agreements put in place (World Trade Organization 2006). Asia appears to be the target of new regional trade agreements. East Asia specifically was expected to participate in approximately seventy deals by January 2007 (The Economist 2006).

It should be noted however that cross-continental food trade does not preclude global opportunities for profit in the agri-food industry (Pritchard and Burch 2003). Investment may be made on a global basis but their argument is that actual activity and movement of goods occurs within regions.

Goodman as well acknowledges that while networks and organizations are intersecting globally for production and marketing purposes, he stops short of claiming that the agri-food system can be characterized as globalized (Goodman 1997). If the definition of globalization is to include the key characteristic of innovation as Goodman asserts, then innovation in the agri-food system requires more in-depth analysis.

One of the impacts of global or cross-continental trade in food products has been an increase in the distance traveled by food and food ingredients and the associated implications to the environment by transportation factors. The term to describe this phenomenon is 'food miles', a term coined by Professor Tim Lang (Friedmann 2004; Lang & Heasman 2005; Pretty et al. 2005). Friedmann notes that a kilogram of asparagus grown in Chile and marketed in New York requires *"seventy-three kilograms of fuel energy and contributes four point seven kilograms of carbon dioxide to global warming"* (Friedmann 2004) p.A9 and will have traveled over eight thousand kilometres. As food retailers look to address consumer demand for cheap food or fresh products on a year round basis, food miles will be a consideration within the overall energy foot print of food production and transportation.

The literature does not support abandoning globalization in general. It will continue to be a key determinant of world economic growth (Kekic 2006). The concern therefore is how to make it work (Blair 2010; Klein 2002;

Stiglitz 2002; Zamagni 2005) to provide social and economic benefits for everyone. That is the primary issue faced by policy-makers. Blair argues that "*globalization pushes people together"* p. 225 and as a result policy-making on the domestic and foreign fronts overlaps. He continues that *"the issue is not how to stop globalisation. The issue is how we use the power of community to combine it with justice"* (Blair 2010) p.365. Blair therefore appears to agree with Porter who contends that globalization is a *"mixed blessing – a worthy end point"* but methods to achieve this outcome often benefit the few at the expense of many (Peters 2002) p.8.

Healthy People, Healthy Environment

Health and the environment are also driving the food industry. Consumer health has been a prime consideration (Barling & Lang 2005b; Cash et al. 2004; Coleman et al. 2004; Friedmann 2004; Hanham 2010; Lussier 2005; Leatherhead 2006; Sleep 2006) in setting food standards and developing new products.

As Barling and Lang point out, consumer health is a concern not only for the consumers themselves but also regulatory agencies. Thus food standards are driving changes and are a key feature of cross-continental food chains. Organizations such as the CODEX Alimentarium Commission, a division of the Food and Agriculture Organization of the United Nations and agencies specific to various nations such as the Canadian Food Inspection Agency (CFIA) set standards for food manufacturing and trade in order to safeguard the food system. These standards can act as non-tariff barriers for third world countries that have difficulty meeting the standards. The main drivers for such safeguards have been the large corporations (Barling & Lang 2005b) in response to consumer demands in developed countries for quality/safe food where the population can generally afford the expense of such measures. The large corporations therefore once again exert their power and control (Barling & Lang 2005b) as their standards have been implemented faster and are more rigorous than those of governments (Ponte & Gibbon 2005).

In addition to the demand for health as it relates to food safety, researchers are uncovering a new understanding of health promoting properties in basic commodities such as tomatoes (Pritchard & Burch 2003). A plethora of

functional foods[3] and nutraceuticals as well as natural and organic food and personal care products are marketed to address the consumer quest for health. Nutrition Business Journal (NBJ) notes that the global market for these products, termed the 'nutrition' industry by NBJ, was over two hundred and thirty-eight billion dollars (U.S.) in 2007 demonstrating a growth of over thirty percent from 2003 figures (Nutrition Business Journal 2008).

The demand for safe and nutritious food products as they relate to health is being surpassed more recently by the growing health epidemic of obesity on a world-wide basis. Obesity is a major issue since half of all the increase in the U.S. health care budget is related to obesity and its impact on chronic disease (Thompson 2005). The World Health Organization (WHO) estimates that one billion people worldwide are obese and an additional three hundred million people are overweight (World Health Organization 2006). These figures are particularly worrisome not only for the health of the population but also for the cost to the economy of the health care sector.

Danaei et al. estimated the number of early deaths in the U.S. attributable to lifestyle, food choices and metabolic factors. They estimated that *"overweight-obesity, physical inactivity, and high blood glucose each caused 190,000 – 216,000 deaths (8% – 9% of all deaths in adults)"* in the U.S. alone in 2005 (Danaei et al. 2009) p. e1000058.

The situation has risen to such heights that Barling and Lang believe obesity and its related diseases could overtake food safety in the next fifteen years as the primary concern in the food system (Barling & Lang 2005b).

[3] Health Canada defines functional foods as:

- **conventional** foods containing naturally occurring bioactive substances (such as dietary fibre in wheat bran to promote digestive regularity, or beta-glucan in oat bran to lower blood cholesterol);
- foods that have been **modified**, by enrichment or other means, in terms of the amount, type or nature of their bioactive substances. An example is margarine that contains added phytosterol, an extract from plant sources that is known to interfere with cholesterol absorption, thereby lowering serum cholesterol levels; and
- **synthesized** food ingredients, such as some specialized carbohydrates intended to feed micro-organisms in the gut.

Health of the environment and its relation to living organisms is also a critical component of the health driver (Cochrane 2005; Hanham 2010; Lang & Heasman 2005). In addition to the environmental effects of food miles as noted above, the current agri-food system is faced with the environmental impacts of the use of pesticides, water consumption and appropriations, excess food packaging, intensive livestock and aquaculture operations, biodiversity losses, etc. (Canadian Agri-Food Research Council and Canadian Agricultural New Uses Council 2003; Cochrane 2005; Fisheries and Oceans Canada 2005; Lang & Heasman 2005; Lawrence 2004).

Packaging for example, much of which can be recycled, contributes significantly to landfills which in some cases have closed due to filled capacity (Lang & Heasman 2005). As landfills meet capacity, municipalities are searching for alternate places to dump their waste. In Britain for example only twelve percent of household waste is recycled or composted (Blake 2005). Some locales have been forced to find landfill space in other regions. Toronto, Canada has been sending waste over the border to the United States. Up to eighty percent of the waste in the landfill of Macomb County, Michigan, U.S. originates in Toronto, Ontario, Canada (CBC 2006).

The use of pesticides is a major concern as well to some consumers. Not only are chemicals used in pesticides but they are often on or in food items without the knowledge of the consumer (Pesticide Action Network North America 2006). Consumers however are fighting back. The result has been the growth of the organic industry. Globally, the value of natural and organic foods was pegged at fifty-four billion dollars (U.S.), up thirty-four percent over the previous year figures (NBJ 2008).

Fossil fuels are yet another health concern. To reduce the impact of fossil fuels on the environment, focus has turned to alternative sources of energy like biofuels utilizing crops such as canola, soy, corn. Other developments include the use of agricultural products or products to develop bioplastics, bioadhesives and biocomposites (Canadian Agri-Food Research Council and Canadian Agricultural New Uses Council 2003). The growth of the biofuel industry however has sparked debate over whether food prices

increase due to a decreased supply of commodities such as corn, soy and canola (Clayton 2006; Mortished 2006).

The availability of water is also of concern for health and the environment. The World Water Council notes that irrigation alone throughout the world accounts for sixty-six percent of total withdrawals of water from available sources (Houlder 2003; World Water Council 2005). The growth in demand for water is expected to increase by forty percent (from 2000-2020) due to an expanding global population and quest for food (Kirby 2000) while the average per person supply of water is expected to drop by a third (Houlder 2003) limiting its use for agricultural production.

The growing demands on the global water supply will impact global eating habits. While a crop such as potatoes requires one hundred litres of water per kilogram of table ready product, one kilogram of beef requires thirteen thousand litres of water (World Water Council 2005). This statistic is indeed disconcerting given that the current growth of the global meat consumption in the developing world is expected to increase four times through to 2020 (Delgado et al. 2006; World Water Council 2005).

Quirky Consumers

Consumers are at the very heart of profit making. The large food manufacturers and retailers spend significant amounts of resources attempting to understand the needs and wants of their consumers and providing solutions (Hodgins et al. 2004).

Consumers for their part have challenged food retailers and manufacturers with patterns that may seem contradictory. Lewis identifies major food trends into 2012: health, convenience, ethnic influences, premium and indulgent, free-from foods (nuts, wheat, etc.), good versus bad fats, bespoke foods (Lewis 2006). These trends are often at odds with each other. The demand for convenience is often achieved through processed food and yet processed food is often deemed less healthy. Consumers are not willing to forego indulgent foods but are prepared to trade healthy eating during the week so that they can indulge in their favourite foods on the weekend (Lewis 2006).

The rise of the ethical consumer has also realized an interesting pathway. Many retailers such as Marks and Spencer, a British based retailer, have responded by making commitments to purchase fair-trade food items as well as goods made from the cotton trade (Rose 2006). Other retailers have followed suit. The Sustainable Agriculture Initiative (SAI) Platform was established and includes membership of large multinationals such as Groupe Danone, Unilever (Fletcher 2006) and Nestle. This group seeks to offer products that respect sustainability and efficiency but also fair business practices in dealing with primary producers (Fletcher 2006).

Consumer concern sparked the SAI. Gabriel and Lang however argue that while consumer activism is likely to continue, the larger organizations (retailers and large manufacturers) maintain a certain amount of control and thus power over consumers (Gabriel & Lang 2006). In addition, consumers are unpredictable and often respond to internal competing interests (Gabriel & Lang 2006). A good example can be found in consumers wishing to purchase and support locally produced food produce and products while driving to Wal-Mart to shop for bargains. This dichotomy between consumer attitude and behaviour will likely be an ongoing challenge.

Burch and Lawrence discuss another area of inconsistency with consumer demand – that of the perception of value (Burch & Lawrence 2005). For many consumers, price is the focus of value (Department of Environment Food and Rural Affairs (UK) 2005). The focus on price has implications on global demand networks when companies seek to meet the demands of price sensitive consumers. Pritchard and Burch describe the instance of a British food company contracting an Italian tomato processing company for baked beans. To meet the necessary price, the processor did not utilize a domestic product but sourced the beans from Mexico and tomato paste from China (Pritchard & Burch 2003). This example supports the notion of the necessity of multiple networks in order to meet short term goals that run concurrent with longer term contracts and goals of a company.

1.2 Innovation

1.2.1 Definition of innovation

Innovation is a topic of interest not only in academic literature but also social media. Its focus targets for both public and private enterprises. The literature is abundant with discussion on innovation, whether in reference to company information, government policy, non government organization communications, law, health or social reform to name but a few areas.

The food system is not immune to the excitement of the terminology or focus. Innovation is used with respect to areas such as communications' technology and the new radio frequency identification (RFID) technology that allows continual tracking of products as they move through various network members; packaging that allows a sandwich to stay fresh for up to a month thus allowing access to distant markets for a regional bakery; processing technology such as microencapsulation that allows fish oil to be incorporated into baked goods without the fishy taste; products such as Gatorade that provide nutrients to athletes to fend off and recover from heat related illness. But what of yogurt in a convenient tube rather than a carton, or an egg containing omega-3 nutrients as a result of flax in chicken feed? Are these examples of innovation or merely just presenting a product in a different packaging format that is more suitable for portability or a food staple with differing nutrients than previously offered to the public?

Innovation is not new (Davila et al. 2006; Freeman and Louca 2001; Jacob 2006). It seems logical therefore that a sound understanding of its concept would be in place with clear criteria for measuring it. The literature however indicates that there is little agreement on the meaning of innovation (Arthur 2009; Conway & Steward 2009). There are several theories outlined below.

One line of thought expresses innovation as an output: a new product or service. The second line of thought describes innovation as a process. The third line is a system. The last line of thinking is a description of characteristics of innovative organizations to encapsulate its meaning rather than providing a definition.

Hamel suggests that innovation is generally regarded as new products some of which appear to be variations of current products such as Gillette adding more blades to its razors (Hamel 2003).

Bercovitz and Feldman support this view and speak of the perception of innovation focusing on technology transfer for commercial benefit (Bercovitz & Feldman 2005). And even more simply, innovation has been described as "*introducing something new*" (Sylver 2006) or "*the act of producing something new"* (Katz 2002) slide 4. While the discussion identifies output, it also combines the theory of innovation as a process by using terminology such as 'introducing' or 'act'.

This line of thinking is consistent with that of Ezell and Atkinson who view innovation as a linear process. They refer to the innovation value chain that begins with the conception of an idea phase and ends with usage phase which results in improved or new products, services, production, processes, organizational or business models. These authors argue that successful innovation is most often a combination of outcomes. For example, a new product that entails a new business model for delivery purposes will have increased chances of success since a new product itself can be copied (Ezell & Atkinson 2010).

The Organization for Economic Development (OECD) also focuses on output. Its definition is often referred to as the Oslo definition: "*An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations*" (OECD 2005) p.46. The focus is clearly on output.

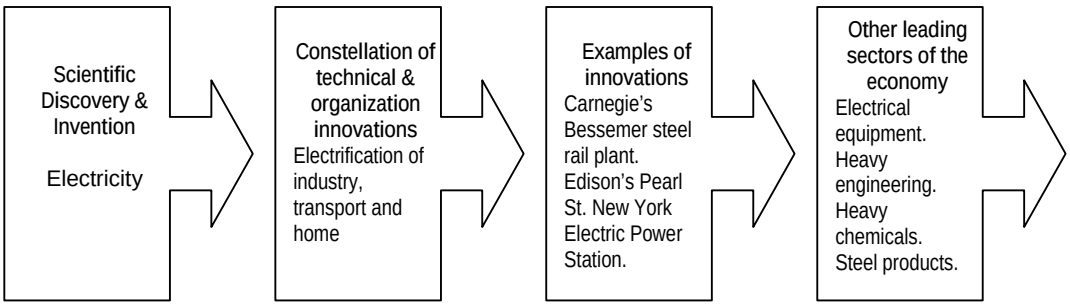
Terwiesch and Ulrich also imply the concept of an outcome with respect to their definition of innovation. While their goal is the creation of value, they propose that innovation is a "*new match between need and a solution"* (Terwiesch and Ulrich 2009) p.3. The match therefore is an outcome rather than the process. They caution however against restricting their outcome to that of a new product or system. As long as the *"new match"* adds value such as the reduction of cost or increase in quality, then it should be classified as an innovation. For example, the new match could be a new

component for a piece of existing equipment that results in less downtime. One could argue that the new component actually is a new product, but the key message is that innovation concerns solving a problem that results in the creation of value which includes financial, societal or environmental value (Terwiesch and Ulrich 2009).

The perception of focusing on output is not surprising given that innovation has been viewed from the viewpoint of economics and the purview of industry (Etzkowitz 2005). It appears to be a self-perpetuating concept as the major driver of economic development is innovation (Bercovitz & Feldman 2005). And as Freeman and Louca conclude, an understanding of both technological and social innovation is critical to understanding and analyzing the history of economics (Freeman & Louca 2001).

This concept is based on the notion that innovation springs from invention. The application of the invention – innovation – is then diffused within the system resulting in new products or processes. Entrepreneurial activity then determines the breadth and depth of the diffusion. Freeman and Louca continue to argue that the process is conducted within innovation clusters where one discovery or invention is applied and leads to a group or constellation as they refer to it of innovations (Freeman & Louca 2001). Figure 2 below provides a schematic of their example of the discovery and invention of electricity which spawned other applications, organizations and significant change in a number of industries.

Figure 2: Scientific invention and diffusion of innovation: example electricity



Adapted: Freeman & Louca (2001)

It is insufficient however to recognize simply change or even significant change in a discussion regarding innovation. To differentiate change and innovation, Zaltman et al. suggest that rather than change, innovation must be regarded in the context of novelty or newness (Zaltman et al. 1973).

Etzkowitz as well speaks of innovation as a process of initiatives, *"an endless transition"* p.1 based on the new knowledge economy. He also refers to innovation as *"the transformation of scientific knowledge into economic activity"* (Etzkowitz 2005) p.11. While supporting the concept of innovation as a process however, it appears that he qualifies the process by suggesting that it must result in some value or outcome. The Conference Board of Canada supports that qualification (Rheaume et al. 2006) by defining innovation as: "*a process through which economic or social value is extracted from knowledge - through the creation, diffusion and transformation of ideas – to produce new or significantly improved products or processes"* (Munn-Venn 2006) p.2.

Peters however identifies the new knowledge itself as the innovation resulting in value to the organization. He argues against innovation equating to ideas. Rather he contends that "*true innovation is instead what we learn when we observe what goes down when we actually test a potentially cool idea"* (Peters 2002) p.209. While his wording in this instance is in the vernacular, the inference is that knowledge or *"true innovation"* p.209 is linked to a process that proves an idea to be valid.

The third theory and one that is gaining strength in the literature is the concept of innovation as a system. Bercovitz and Feldman describe innovation as a system comprised of three environments: legal, economic and policy (Bercovitz & Feldman 2005). Jacob as well speaks of innovation in system terms noting that the system is based on the premise that innovation is a collective process and cannot be accomplished in isolation of other actors (Jacob 2006). Having said that, she also notes that there are two approaches to systems of innovation. The first approach involves all institutions that create and receive value from innovation while the second approach focuses specifically on technological innovations.

Katz' view of innovation has evolved from a process to a system, a complex system (Katz 2006). He notes that these complex systems are evident by six specific descriptors: they have *"a dynamic structure"* … are *"open in the sense that information flows across its boundaries"* … possess *"structures that span many scales"* … exhibit *"emergent behaviours and patterns that are not caused by a single entity in the system"* … *"can self-organize"* … are *"composed of complex subsystems"* (Katz 2006) p.895.

Hamel refers to radical innovation (Hamel 2003) suggesting that there are degrees of the innovation. Baber as well as Bercovitz and Feldman also make reference to the levels. These authors argue that the more radical or transformative the innovation, the more challenging and need for other organizations to be involved with the transformation of the knowledge into value (Baber 2005; Bercovitz & Feldman 2005) thus the increased reliance of complex networks.

Davila et al. take the concept of levels further. They argue for consideration of three types of innovation: incremental, semi-radical and radical (Davila et al. 2006). While incremental innovation refers to small product or process improvements, they argue that radical innovation results in entirely new approaches to meeting organizational objectives resulting in meaningful change. These authors refer to innovation as *"an agent for change"* p.5. Steward however describes this type of change as transformative rather than radical (Steward 2010b).

Drucker supports the notion of meaningful change. He refers to innovation as an *"effort to create purposeful focused change in an enterprise's economic or social potential"* (Drucker 1998) p.6. While the focus in Drucker's definition is on 'effort', in other words process, he also suggests that meaningful change is the goal.

Steward supports the notion of change. While he terms innovation within the concept of transforming something that is new or novel into practice, he qualifies it (in his Inaugural Address) by also noting that the goal is to *"change the world in which we live"* (Steward 2010a). In other words, he supports the notion that to affect real change, innovation must be

transformative in nature. He notes that this type of innovation requires *"a full system redesign and culture change in the way people think about products and services"* (Steward 2010b) slide 6.

Steward's work with Conway also provides a clear definition of innovation which does not take into consideration the radical component. Their definition is *"innovation = invention + bringing into common usage"* (Conway & Steward 2009) p.10. The concept that an invention is brought into common usage denotes the value that is placed on invention by its users. Invention however does not always result in changing the world as was referred to in the previous paragraph.

Change was also at the core of Nelson and Winter's definition of innovation. They argued that innovation involves uncertainty and is evolutionary in nature. It must also take into consideration organizational complexity and diversity. *"Almost any nontrivial change in product or process, if there has been no prior experience, is an innovation … any innovation as involving considerable uncertainty both before it is ready for introduction to the economy, and even after it is introduced, and thus we view the innovation process as involving a continuing disequilibrium"* (Nelson & Winter 1977) p. 47.

Ridley supports the premise that change is evolutionary in nature. He discusses it in the terms of technological change and proposes that change resulting in real value *"comes from attempts to improve existing technology … and only rarely as a result of the application and transfer of knowledge from the ivory towers of the intelligentsia"* (Ridley 2010) p.258. He equates innovation with change, particularly technological change, which implies a process or a system.

A review of the literature also identifies key elements or characteristics of innovative companies. The ability to capture knowledge and translate knowledge into value is a predominant theme (Barber 2003; Bercovitz & Feldman 2005; Dobni 2006; Dobni 2008; Etzkowitz 2005; Munn-Venn 2006). The knowledge is itself dynamic and is a result of increasing reliance on interdisciplinary networks. Baber as well as Bercovitz and Feldman argue that these networks pose challenges due to increasing

number and complexity of global networks of scientists (Baber 2005; Bercovitz & Feldman 2005), both natural and social.

These networks however result in innovative activities. A recent survey conducted by the Conference Board of Canada found that the creation and translation of knowledge into one new product or process is a result of the generation of approximately one thousand ideas (Rheaume et al. 2006). The complex networks therefore play a critical role in innovation.

Other descriptors are identified in the literature. For example, the literature identifies innovative organizations investing significantly in research and development with the majority of employees classified as highly qualified people (HQP) (Baber 2005). These HQP are not only encouraged but expected to be risk-takers. Risk-taking is also a characteristic of innovative organizations (Baber 2005; Dobni 2008; Terwiesch and Ulrich 2009). This characteristic provides an environment that allows employees to experiment and recognizes that not every experiment results in success.

Hamel also refers to descriptors or variables in the process of innovation and that any one or several variables can change or be challenged quickly (Hamel 2003). Coates and Dobni support this argument and note that innovative organizations demonstrate flexibility and the ability to react in a timely manner (Coates 2005; Dobni 2008). Critical to these descriptors is the notion that leadership is required to provide the environment that allows organizations to react to those changes.

Along that line, Davila et al. add that innovation is comprised of a number of *"elements … leadership, strategy, processes, resources, performance metrics, measurement and incentive rewards"* (Davila et al. 2006) p.43. Dobni adds to the elements by noting that strategies must be *"disruptive"* requiring *"revolutionary thinking"* (Dobni 2006) p.330.

As well, innovation is open to serendipity (CIHR 2006; Conway & Steward 2009; Johnson 2010; Yapps-Cohen 2000). Serendipity includes fortuitous situations such as *"being in the right place at the right time"* (Conway & Steward 2009) p.322 and stumbling upon opportunity which results from

unintended consequences. Johnson describes serendipity as *"the power of accidental connection …* [that] *is meaningful to you"* (Johnson 2010) p.108.

While Johnson describes the importance of the serendipitous nature of innovation, he identifies establishing the environment that *"foster serendipitous connections"* is extremely challenging (Johnson 2010) p. 109.

Yapps-Cohen provides an example of the latter point by describing the discovery of aspartame. Researchers at G.D. Searle & Co. laboratories were attempting to find new chemical compounds that could be used to treat ulcers. Only by an accidental tasting of one of the compounds did the researchers discover that it was very sweet thus leading to the market success of the NutraSweet brand of aspartame. The reason Yapps-Cohen classifies this example as serendipitous is that the tasting was accidental. As well the product was developed to treat ulcers rather than being a sweetener (Yapps-Cohen 2000).

Table 1 below provides an overview of varying definitions or concepts of innovation

Table 1: Concepts of innovation in the literature

Concept of Innovation	Primary Focus	Goal
Output (3,11,13,19,24)	New: • Product • Service • Technology • Process	Provide value: • Economic • Environmental • Social
Process (10,12,17,18,20,21,22,23,24, 25)	Commercialization • Implementation of an idea • Market acceptance	Provide value: • Economic • Social • Change
System / complex system (1,2,3,5,14,15)	Networks of knowledge	Creation and diffusion of knowledge Act as change agent
Organizational descriptors (1,2,3,4,7,8,10,13,15,25,26)	Capacity and capability to create something new	Provide value: • Economic • Social

Sources: 1) Baber 2005, 2) Barber 2003, 3) Bercovitz and Feldman 2005, 4) Coates 2005, 5) Conway and Steward 2009, 6) Davila et al. 2006, 7) Dobni 2006, 8) Dobni 2008, 9) Drucker 1998, 10) Etzkowitz 2005, 11) Ezell and Atkinson 2010, 12) Freeman and Louca 2001, 13) Hamel 2003, 14) Jacob 2006, 15) Katz 2006, 16) Kelly 2010, 17) Munn-Venn 2006, 18) Nelson and Winter, 1997 19) OECD 2005, 20) Rheaume et al. 2006, 21) Ridley 2010, 22) Peters 2002, 23) Steward 2010a, 24) Sylver 2006, 25) Terwiesch and Ulrich 2009, 26) Zaltman 1974

Hamel argues that the concept of innovation must be expanded (Hamel 2003). Coates concurs and notes that innovation is all too often focused on economic activity rather than inclusive of processes and the humanities (Coates 2005). Dobni as well agrees. In describing his '*Innovation Blueprint*', he argues that the concept of innovation has not been examined and understood well enough for organizations to implement effectively (Dobni 2006). Nelson and Winter add to the confusion by observing that the concept itself differs by sector (Nelson & Winter 1977).

Gray and Weseen support Nelson and Winter's assertion. They provide the example of innovation in the agriculture sector and point to four specific factors that point to its uniqueness in the agriculture sector: 1) the relative number of small farms lack the resources to conduct research and development independently; 2) research based on nature must be conducted in a sequential manner which may not be the case in other sectors of the economy; 3) many new agriculture and food products cannot be patented; 4) producer organizations are often the source of funding for research (Gray & Weseen 2008).

Regardless of whether innovation is perceived as an output, a process, system or through descriptors of an organization, or combination of any of these, it demands further examination.

1.2.2 Why is innovation important?

Innovation is often measured by growth in productivity as a result of the introduction of new technologies and innovations (Georghiou 2006; Nelson & Winter 1977). It therefore is seen to be the economic driver for industry and government or country alike (Ezell & Atkinson 2010).

Most authors agree that innovation is required to gain a competitive advantage and generate growth within an organization or economy (Davila et al. 2006; Department of Trade and Industry UK 2003; Dobni 2006; Etzkowitz 2005; Ezell & Atkinson 2010; Hamel 2003; Rheaume et al. 2006). Freeman and Louca agree and note that successful diffusion of innovation through the development of constellations of innovation results in increased growth of the gross domestic product – an economic indicator

– and the emergence of new industries and technologies (Freeman & Louca 2001).

While many companies focus on incremental innovation, Hamel notes that economic growth results only from radical innovation (Hamel 2003). Davila et al. define radical innovation as *"a significant change that simultaneously affects both the business model and the technology of a company"* (Davila et al. 2006). But clearly, innovation will affect areas well beyond an organization. Davila et al. provide the example of the introduction of the disposable diaper and the resulting impact on home baby care (Davila et al. 2006). The development of the internet and its effect on the communication capabilities of organizations and individuals globally provides another example (Castells 1996).

At the very heart of innovation as an economic driver, the goal is profitability. But as Freeman and Louca observe, innovation offers no guarantee of returns to the shareholders. The authors note however that intangible benefits may accrue from innovation such as power and influence (Freeman & Louca 2001).

For their part, governments find their constituencies living and operating in a global environment – one marked by an increasingly changing technological environment and competition from various regions throughout the world (Department of Trade and Industry UK 2003). In this context, innovation is seen as a regional economic development tool, sustaining jobs and regions. Cerny argues that the global competitive environment has resulted in governments evolving from nation states to competition states where social and economic goals are sometimes in conflict (Cerny 1997).

Etzkowitz views innovation as a necessity to solve an economic or social problem. In addition, he views innovation as a development tool for developing countries (Etzkowitz 2005) once those tools have been proven in more stable environments. In this respect, innovation resulting in new technologies is deemed to result in higher standards of living (Government of Canada 2002).

There appears to be no dispute that science and technology are viewed as being at the heart of innovation. Governments however are under increasing pressure to ensure a return on investment for publicly funded research which forms the basis of innovation. Government policies therefore are placing increasing pressures and importance on the outcomes of innovation (Bercovitz & Feldman 2005).

The challenge however is actually capturing and quantifying the value of those outcomes. Linden et al. argue that there is little understanding of how that is accomplished. They argue that due to the complex nature of innovation with its global networks in combination with off-shore manufacturing, economic benefit is not often captured within the region that spawns the innovation (Linden et al. 2007).

It will be important for governments, researchers and industry however to be cognisant of social goals, not just economic goals. One of the key assumptions is that society has the ability to channel knowledge into innovation that will assist it to meet its objectives (Nelson & Winter 1977). These goals however must provide both economic and social benefit.

1.2.3 Who are the actors in innovation?

Innovation is based on a key premise of the interconnectedness and multi-disciplinary nature of idea generation and development in today's global economy (Baber 2005; Bercovitz & Feldman 2005; Etzkowitz 2005). Not only are researchers connecting with other researchers in different regions of the globe as well as different disciplines but industry is as well with the goal of transforming knowledge that provides an economic and/or social benefit. In fact, companies are partnering not only with members of their demand network but also competitors (Rheaume et al. 2006). In addition, government is a key player in the network.

The interconnectedness of the various actors indicates that the environment required for innovation and the process of knowledge transfer is not linear (Jacob 2006) and involves a cast of actors. The literature identifies three main categories of actors with a fourth and fifth gaining increasing importance in the sphere of innovation. The first three are government, education/learning and industry and two being civil society

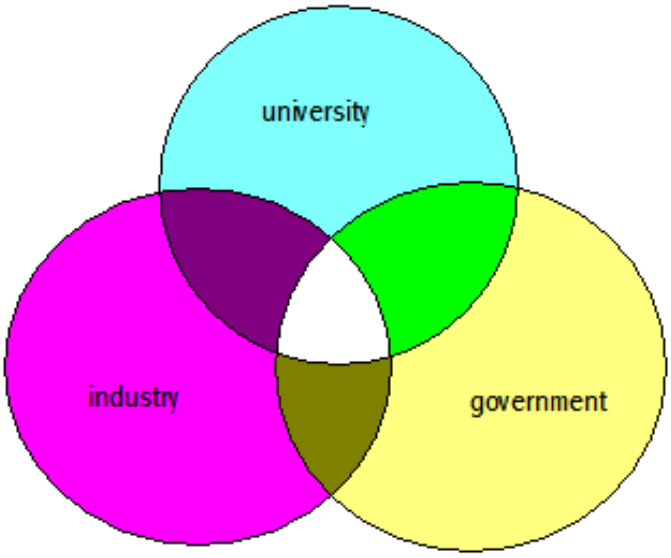
and the public. Another actor has appeared and will also be discussed: the non-human actor.

Three divergent models have been put forward: The triple helix, the systems of innovation and actor network theory.

1.2.4 The Triple Helix of Innovation

The theory of the triple helix of innovation (Etzkowitz 2003) was first put forward by Etzkowitz and Leydesdorff in 1997 signifying the complexity, interdependency and dynamic nature of innovation, one that is continually in transition due to its very nature of being knowledge based (Etzkowitz & Leydesdorff 1997). In addition, the theory of the triple helix focuses on outcomes – specifically economic returns or knowledge into wealth (Jacob 2006). Figure 3 below demonstrates the concept.

Figure 3: The triple helix of innovation



Source: (Etzkowitz 2003)

While the triple helix demonstrates the integral role that each actor plays in the helix, Bercovitz and Feldman found that the majority of studies they reviewed on the triple helix identify the university as the focal point and

therefore the impetus for innovation within the triple helix actors (Bercovitz & Feldman 2005).

Etzkowitz however argues against this. He posits that the roles of the various actors in the triumvirate have become more blurred such that: universities now take on economic activity; industry is involved in research and development activity; and the government has transitioned into entrepreneurial activity (Etzkowitz 2005). Etzkowitz therefore concludes that that no one actor can play the lead role in innovation, that it is combination and interplay of the three actors that results in innovation (Etzkowitz 2005).

Baber supports this concept and notes that each member of the triple helix has taken on features of the other. He notes that the evolution is a result of four factors. First, the *"capitalization of knowledg*e" p.6 reflects the premise that knowledge represents a price tag. Corporations are now funding university based research. Second, is *"the erosion of government funding and the grants' economy"*, p.7 resulting in economic development goals of universities through spin-off companies and licensing royalties. Third, is the *"nature of transformative technologies"* p. 7 that requires the input from all actors to bring about change? And lastly, Baber identifies the *"globalization of scientific and technical research"* p.8 that has become commonplace (Baber 2005).

Barling and Henderson support the changing roles and found that industry is taking a stronger role in directing research in publicly funded institutions. In their examination of the public sector research into genetically modified food and food crops in the United Kingdom, the authors argued that industry was strongly influencing the direction of research away from basic research and towards research that could be commercialized. Therefore while the interplay of the three actors in Etzkowitz' triple helix are relevant, some sectors demonstrate a stronger influence in the area of research that results in innovation (Barling & Henderson, 2000).

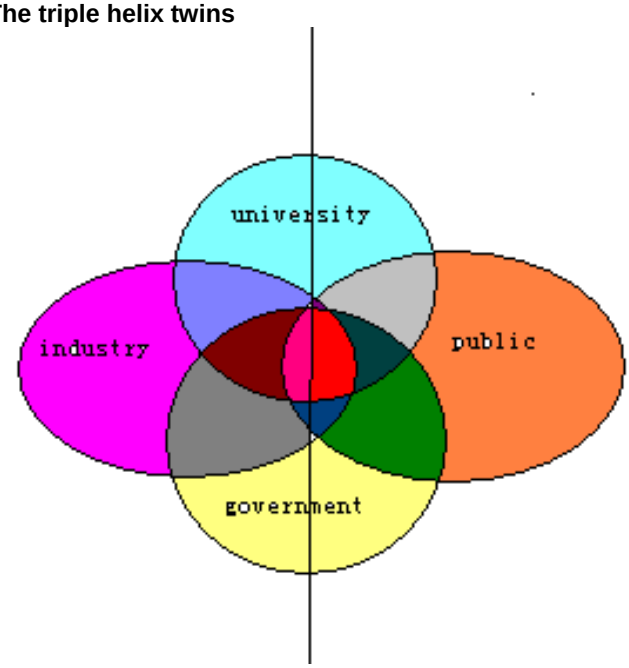
Kenney also supports this view. He notes corporations and universities are forming closer relationships although to varying levels based on the sector. The rationale for the closer ties is clearly to gain financial benefits from the

corporation for the university in question (Kenney 1986). The result is industry led research that may only be accessible to specific corporations.

Civil Society and the public are new additions to the triple helix theory. Etzkowitz developed the model further by proposing the trip helix twins as identified in Figure 4 on the following page (Etzkowitz 2004). Both Etzkowitz and Baber recognized that a second generation of the triple helix should be considered that is inclusive of civil society as represented by non-government organizations and the public (Baber 2005; Etzkowitz 2004). With respect to NGOs, Baber argues for their inclusion as they have become powerful and a source of funding for research and development (Baber 2005). In the United States alone, there are approximately one to two million NGOs (Lang & Heasman 2005), many representing significant sources of funds for research and development purposes.

Etzkowitz divides the twins' model in two: one twin focusing on innovation and the second, sustainability (Etzkowitz 2004). The second twin substitutes the public for industry as demonstrated below and appears to acknowledge the need for the integral nature of economic and social outcomes. The challenge for this twin model is that public input is often not valued by the academic community (Coates 2005).

Figure 4: The triple helix twins



Source: (Etzkowitz 2004)

The twins and their roles however should not be considered mutually exclusive. While Etzkowitz sees the public's role in areas of sustainability, there is evidence that industry sees the public as an integral role in innovation (the left twin) (Etzkowitz 2004). In a recent survey on innovation conducted by the Conference Board of Canada, eighty percent of the companies identified the public and customers as the key source of new ideas and opportunities (Rheaume et al. 2006).

The public is also becoming an important player in the field of innovation as the new transformative technologies in areas such as biotechnology, genomics and nanotechnology generate public anxiety (Baber 2005). Baber argues that public engagement will be critical if innovations in various fields are to be used for the benefit of society.

1.2.5 Systems of Innovation

Jacob's review of the systems of innovation appears to be more inclusive of other areas of learning than just the universities. While she acknowledges one approach in systems of innovation that focuses on technological innovation – thus wealth creation – which is more consistent with the triple

helix model, the systems' approach appears to be inclusive of the disciplines other than the natural sciences as well as inclusive of other institutions and networks focused on learning and training (Jacob 2006).

Rheaume et al. note that it is industry that transforms knowledge into tangible results therefore making it a focal actor for innovation (Rheaume et al. 2006). Jacob however suggests that the systems of innovation are not just about the interdisciplinary nature of the innovation but the inter-dependency of institutions in order to achieve innovation. She continues that the two main strengths of this model are focusing on innovation as ever evolving and the critical importance of learning (Jacob 2006).

A comparison of the two models – the triple helix and the systems of innovation – reveals striking similarities. Both models recognize the interconnectedness and contributions required of various actors for innovation to occur. They both speak of the non linear nature of innovation as it evolves up, down, across and through the network, the triple helix, the system. Where they appear to differ is the expanse and nature of the actors and where innovation occurs. The triple helix focuses on the transformation of the knowledge created by a network of actors to create value and wealth. And the systems' approach is more multi-dimensional resulting in innovation within varying sectors, regions, nations, technologies, social entities, etc. Jacob argues that to understand innovation, both the triple helix model and the systems of innovation model must be utilized (Jacob 2006).

Clearly some government actors are focusing their emphasis on the approach that results in wealth creation. Both the Governments of the United Kingdom and Canada have entrusted their innovation strategies to departments whose responsibilities are the creation of value for the economy – that is the Department of Trade and Industry in the United Kingdom and Industry Canada. Jacob notes that Sweden has established a national agency for the development of innovation systems – VINNOVA. While the organization recommends policies that will enable the growth of innovation in Sweden, it also funds systems of research and development in areas of technology, transportation, communication and working life (Jacob 2006).

1.2.6 Actor network theory

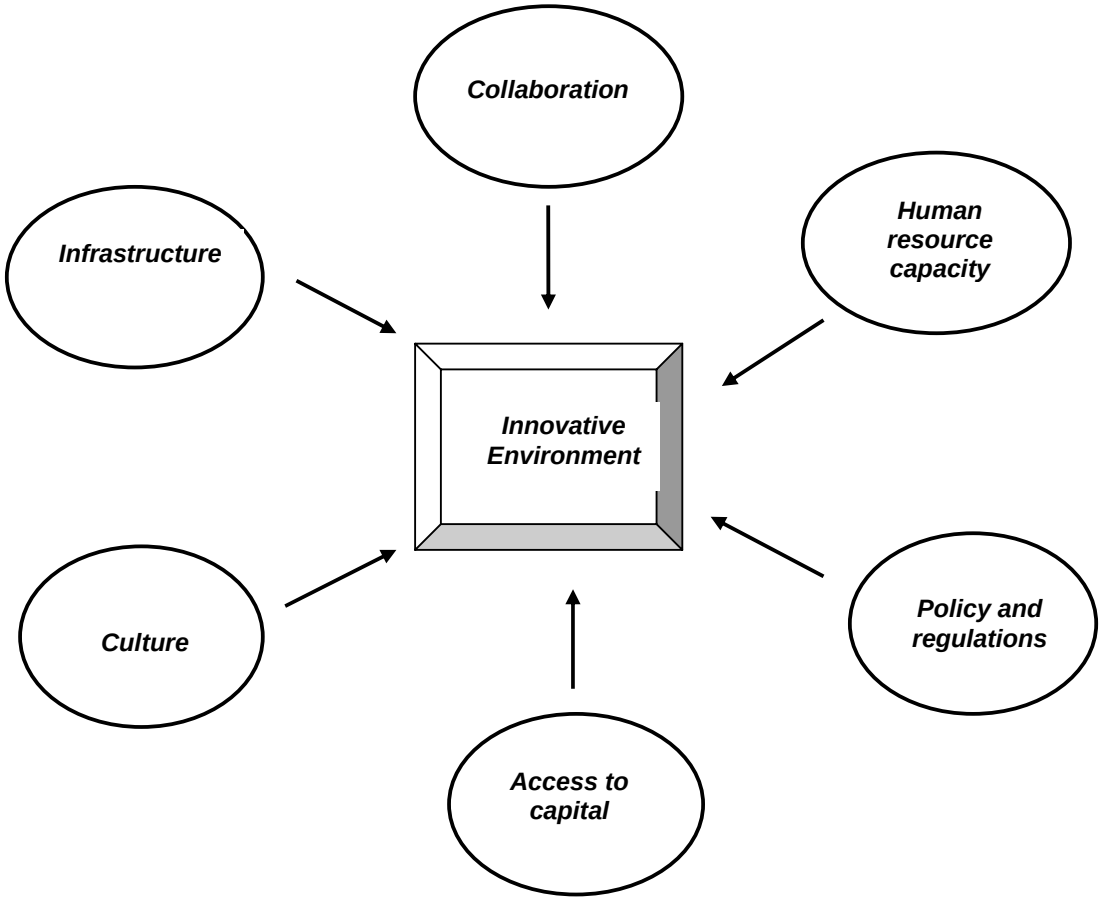
Conway and Steward discuss actor theory with respect to innovation. Reflective of the complex networks that comprise innovation, actor network theory is marked by *"the dynamic and political nature of interactions between actors"* (Conway & Steward 2009) p. 80. This theory argues that actors must be considered more than the actor groups identified in the triple helix but must also include technology. The theory argues that non human or non organizational actors play a role in actor network theory (Callon 1992; Conway & Steward 2009; Law & Callon 1988).

Technology is assumed to be a key component of innovation and therefore technology such as computers and the internet must be included as an 'actor' in the theory. Their role is to act as a framework for networking with nodes linking the various actors. (Conway & Steward 2009)

1.2.7 What does it take to have an innovative environment?

A review of the literature indicates six main factors that mark an innovative environment: collaboration among the actors; human resource capacity; policy and enforceable regulatory environment; access to capital; culture; and infrastructure. Figure 5 on the following page provides an overview of the factors.

Figure 5: Factors influencing an innovative environment



Given the agreement in the literature of the growing interactions of the various actors in innovation, it is not surprising that relationships and collaboration are identified as critical measures (Baber 2005; Bercovitz & Feldman 2005; Dobni 2008; Etzkowitz & Leydesdorff 1997; Munn-Venn 2006; Rheaume et al. 2006). Collaboration however can be challenging. Govindarajan and Trimble found in their research working with Fortune 500 companies that collaboration with respect to innovation is challenging due to tensions between innovation and operational personnel. They found that employees focusing on innovation activities are often isolated from the rest of the company. These authors however argue that *"isolation may neutralize infighting, but it also neuters innovation"* (Govindarajan & Trimble 2010) p.77.

The WEF identifies one relationship in particular by arguing that research collaboration must by *"extensive"* between university and industry (Sala-i-Martin et al. 2010) p.8. The level of effectiveness of these collaborations among all actors within the triple helix is not well understood however and should be examined further (Etzkowitz & Leydesdorff 1997).

The second measure, that of human resource capacity, is critical in a process or system that is based on knowledge. Skills and knowledge are required to create and diffuse innovations (Freeman & Louca 2001). Access to skills can be accomplished through training and education or through mobility of labour both of which are deemed essential to systems of innovation (Cotic-Svetina et al. 2008). Labour mobility also ensures that new knowledge is diffused not only within the actors within a region, but also in other regions or industries. In this manner, knowledge does not become institutionalized (Bercovitz & Feldman 2005; Cotic-Svetina et al. 2008). As an added dimension to the concept, Niosi and Caicedo suggest that the sharing of knowledge is accomplished at graduation from institutions of higher education and training, when graduates move into positions with other actors. This movement of the graduates allows the transfer of knowledge from universities to industry, building capacity in that actor group (Niosi & Caicedo 2005).

With respect to the food system, The Institute of Food and Science Technology (IFST) sent out a warning. It noted a significant reduction in enrolment and graduates of food-related programs. The IFST cautioned that this growing gap in the number of graduates represents a critical threat to the food industry and in fact has resulted in a word of warning to the industry that *"the food industry is becoming an innovation backwater"* (Nutraingredients.com/Europe 2006). Access to highly qualified people therefore is a growing issue for the food industry.

Policy and an enforceable regulatory environment are combined as the third factor that enables an innovative environment. This factor includes intellectual property (IP) enforcement (Sala-i-Martin et al. 2010). The growing call for higher standards in IP enforcement however is seen as a detriment to innovative activity in smaller countries and small companies. Tansey argues that higher standards are also a detriment to innovative

activities in agriculture *"where informal innovation systems and exchange mechanism underpin the innovation practices of traditional farming"* (Tansey 2008). A discussion on policy and regulations are expanded in Section 1.3.

Access to capital is also deemed essential for innovation (Freeman & Louca 2001; Lopez-Claros et al. 2006a; Hodgins et al. 2004; Sala-i-Martin et al. 2010; The Economist 2006). The literature points to investment for research and business development for both institutions and entrepreneurs. Sala-i-Martin et al. also argue that the private sector must demonstrate significant investment in research and not rely solely on public funds (Sala-i-Martin et al. 2010). Etzkowitz however argues that based on his research publicly funded venture capital is increasingly important to spawn innovation in the private sector (Etzkowitz 2005).

Investment into research and development is often used as one measure of a country's innovation performance. Katz refers to it as the intensity of research and development which is measured by examining the country's gross domestic expenditure on research and development (GERD) divided by the gross domestic product (GDP) (Katz 2006). Note that GERD includes public and private investment figures.

Infrastructure is also critical to an innovative environment. Infrastructure was described as research and educational institutions, communication, transportation and entrepreneurial activity (SMEs or spin-off companies) all identified specifically as necessary components of innovation diffusion (Hodgins 2010a; Llerena & Matt 2005; Moulaert & Sekia 2003; Freeman & Louca 2001). Smith et al. offered the strongest support by arguing that inadequate infrastructure is a major drag on innovation (Smith et al. 2005).

The literature also identifies culture as an element of an innovative environment (Baldwin 2006; Freeman & Louca 2001). The culture reflects openness to change and is flexible. Baldwin argues that proven innovation is dealt a blow by established systems. He offers the example of Village Homes built in Davis, California. A group of two hundred and twenty homes were built that were energy efficient and ecologically sound. Even though the initial costs of the homes were more expensive than traditionally

built homes, utility bills proved to be about fifty percent less. Developers successfully worked past the barriers blocking the housing development. Even though the development has proven successful, Baldwin maintains that the concept has not been replicated due to a culture that is built on bureaucracy and supportive of the current mode of development (Baldwin 2006).

The 2010-11 rankings for the top innovative countries were identified by the World Economic Forum as Japan, Switzerland and Sweden respectively (Sala-i-Martin et al. 2010).

1.3 Policy

1.3.1 Definition of policy

Two lines of thought regarding policy were found in the literature. The first focuses on policy as decision-making and implementation of those decisions. The second line argues that policy is about dialogue and learning.

The first and most predominant description of policy supports the view that policy is about making decisions that address issues of interest to the public (John 1998) and how decisions will be made. In other words, decision-making is a process. This process can appear to be chaotic and unpredictable due to the various tensions at work in the process (Lomas 2000). Lang adds that this decision-making or policy-making process can be unclear and lack precision (Lang 2010) lending credibility to Zussman's argument that policy-making is an *"art"* requiring *"judgement"* (Zussman 2003) p.70.

John adds that policy relates directly to the political process (John 1998). Tansey and Worsley support this view. They argue that politics itself operates in the public interest to protect individuals and businesses (Tansey & Worsley 2004) and therefore politics and policy are inextricably entwined.

Lang and Omand et al. agree that the political element of policy is intricately entwined in defining policy-making. They argue that policy or

decision making is the translation of the political vision into actions that result in the desired outcomes for public and private benefit (Lang 2010; Omand et al. 2009). Within this process, Omand et al. also argue that policy-making should be considered a process that not only is about vision and outcomes but about dialogue (Omand et al. 2009). Dialogue by its nature refers to an open discussion within and among actors to gain a better understanding of an issue or problem and an exploration of potential solutions.

Smith et al. add that policy must emphasize agency, the implementation of the decisions made that result in public or private benefit (Smith et al. 2005).

The literature also supports the notion that policy is about dialogue and learning. Russell and Greenhalgh offer a *"policy-as-discourse"* approach to the policy process (Russell & Greenhalgh 2009) p.10. They argue that policy should focus on dialogue, exploring the assumptions made about complex issues as well as a discussion of the options. The focus for decision-making or policy-making therefore is on the process rather than finding a solution for a problem. The implication of this approach therefore is that a policy-as-discourse approach focuses on building analytical capacity rather than finding solutions to address an issue or problem.

Parsons supports this view and argues that the goal of policy-making should be considered a process upon which the public learns and explores options for solving issues of importance to them. The focus therefore is not on the outcome but in the engagement of the public and private enterprises to increase their capacity to analyze issues and information (Parsons 2002).

The literature also identifies different approaches to policy-making. For example, policies can be punitive in nature. Cash et al. point out that government penalizes consumers by taxing food items that are perceived to have no or limited food value such as crisps, or soda rather than developing and implementing policies that reduce the higher costs of health products such as fruit and vegetables (Cash et al. 2004).

Primarily, the approaches in the literature focus on the methodology of policy-making and its evolution. John notes that the approach has changed over the last century. At the outset of the 1900s, government took an institutional approach imposing policies on its electorate. The process then transformed into a group approach during the mid 1900s where the various actors came together to develop policy. By the 1960s and 1970s, the socio-economic approach took hold where outcomes targeting specific disciplines determined policies and their projected outputs. That approach then evolved into the rational choice approach of the 1980s and 1990s and combined the salient features of the other approaches (John 1998). John identified the approach in the developing world in the late 1990s as being ideas' based. This concept suggests that ideas are floated around to various actors for analysis, input and strengthening. In the event that the ideas are deemed credible, 'the ideas in effect create the policy' (John 1998). But as John cautions, this latter approach requires the input of experts to assess the ideas.

The ideas-based approach evolved to the call among academics for an evidence-based approach to policy-making (Millstone 2003). The literature demonstrates a strong body of support for an evidence-based approach to policy-making (Barling & Lang 2005a; Cable 2003; Cash et al. 2004; Howlett & Newman 2010; Lang 2010; Lang & Heasman 2005; Lang et al. 2009; Lomas 2000; Marston & Watts 2003; Omand et al. 2009; Osborn 2006; Russell & Greenhalgh 2009; Zussman 2003). Evidence-based policy-making was founded on the medical model of clinical research. The concept focuses on the provision of evidence for decisions taken with the goal of improving the quality of policies and reducing the risk of policy failure (Head 2010; Howlett 2009).

Dobrow et al. argue that the evidence-based approach concerns justifying the decision made and actions taken (Dobrow et al. 2004). The goal of evidence-based policy-making therefore is to make decisions based on information rather than opinion (Davies 2004). It is the application of logic to policy-making (Marston & Watts 2003) with the goal of reducing the incidences of policy failure (Howlett 2009; Millstone 2003).

Evidence, the foundation of this model of policy-making, is itself the basis of criticism of the evidence-based approach. The core arguments putting evidence into question relate to the source and quality or validity of the evidence (Marston & Watts 2003; Parsons 2002) as well as the ability of users of the evidence to evaluate and understand its applicability and implications (Howlett 2009; Parsons 2002). The researchers have also been criticized for not understanding the information needs of the policy-makers therefore providing evidence that does not fit the needs of the intended user (Choi et al. 2005; Head 2010). As a result, the user may also view evidence as being abstract and of little value (Russell & Greenhalgh 2009).

In addition, the quest for evidence can result in conflicting results of the researchers (Maxwell & Slater 2003; Zussman 2003). Researchers are often asked to gather soft data requiring interpretive skills. This evidence is then open to accusations of subjectivity (Zussman 2003). Howlett points out that social research is particularly open to this issue (Howlett 2009). These points lay the foundation for the question regarding what actually constitutes evidence (Choi et al. 2005; Dobrow et al. 2004; Marsten & Watts 2003).

Lang adds to the discussion on evidence by arguing that evidence is often focused at the few rather than population based putting into questions its validity (Lang 2010).

Head argues that the issues related to evidence often prevent the policy-maker from incorporating evidence into the decision-making process (Head 2010). Howlett adds to the argument by noting that agreement persists as to whether evidence-based policy-making actually meets its goal of reducing the incidence of policy failure (Howlett 2009). As a result, Head argues that evidence should not be considered a basis for policy but rather to inform the process (Head 2010).

The more recent literature is calling for an evolution in evidence-based policy-making. It calls into question strict adherence to evidence due to the reality of the context in which policies are made both from the complexity of the problems addressed and solutions sought as well as tensions between

and among the various actors (Lang et al. 2010; Millstone 2003; Omand et al. 2009). This point is expanded in Section 1.3.3 below.

Evidence plays a vital component of policy as it relates to innovation and science policy. Millstone argues that the political element must not be negated but is used as a framework for evidence. Evidence he argues is extremely important with respect to science-based policy. He continues that evidence lays the foundation for policy options that are based on knowledge, identifies knowledge gaps and consequences of the various options (Millstone 2004).

1.3.2 The necessity of policy in the agri-food sector

Food policy

Policy as it pertains to the food system often focuses on specific segments of the food system. For example, Wilson and Finkle discuss policy as it relates to agriculture. They argue that agriculture is different than other policy areas of government due to its multi-dimensional impact on the social, political and economic environment of a country (Wilson and Finkle 1990) and therefore should have special policy directives. Tansey and Worsley agree with this perspective and categorize food policy within the context of socio-economic policy (Tansey & Worsley 2004).

With respect to agriculture and food, the shift in emphasis at least in rhetoric moved away from agriculture policy to food policy to give attention to the consumption end of chain rather than the production end (Cash et al. 2004). Flueck-Chaloupka et al. argue that in fact food has moved beyond the production and delivery of commodities. They argue that it has entered the realm of the development of products and technologies that deliver nutrients and other benefits to the body (Flueck-Chaloupka et al. 2005). This argument however also lends itself to policy development in silos.

Rather than production end of the food system, Nestle focuses on the impact of policy on the end user. Her focus lies on the decision-making process as it relates to nutrition and the end user. She argues that the strength of the lobbying activities of the large producer groups and large and multi-national food companies have had on nutrition policy has

negatively impacted the health of the citizens of the United States, her country of study (Nestle 2002).

A broader view of policy as it relates to the food system emerged and is captured under the umbrella of food policy. Timmer et al. define food policy as *"the collective efforts of governments to influence the decision-making environment of food producers, food consumers, and food marketing agents in order to further social objectives"* (Timmer et al. 1983). As is evident, their focus of food policy reflects one targeting public policy.

Lang et al. however offer a more holistic definition of food policy. They view it as *"the pursuit of improved knowledge of how policy-making determines and responds to the food system"* (Lang et al. 2009) p. 21. They argue that the process of policy-making is interdisciplinary due to the diverse tensions that exist within the food policy environment and the implications of policy implementation on a broad range of actors and issues (Lang et al. 2009).

As noted by Nestle above and supported by Lang, food policy is marked by the influence of politics (Lang 2009; Nestle 2002). Lien agrees and notes that it is important to acknowledge the link between policy-making and politics, and food and politics. Lien so aptly and succinctly captures the notion of the political stage to which food has now been elevated by concluding that *"food has emerged as a political topic par excellence"* (Lien 2004b) p.1. She acknowledges that food has always been at the political forefront.

Other authors also agree with new dynamics of the food system and the challenges presented to the policymakers. The new food system is marked by the interconnectedness – both in breadth and depth – of the demand networks throughout the globe and the actors participating in the systems. (Held et al. 1999; Lang 2003; Lang & Heasman 2005; Lang et al. 2009; Lien 2004b). This increasing interconnectedness forces policy-makers to take into consideration the impact of their policies as well as policies of other regions that affect the domestic sector, in other words the context in which policy-making is undertaken.

The concept of the politics of food has expanded and requires new thinking (Lien 2004b). Tansey and Worsley concur with her analysis. They argue that in order to understand policymaking, policymakers must have a good understanding how the system operates regardless of industry and who benefits from current policies (Tansey & Worsley 2004).

Food and food policy therefore are no longer simply within the realm of agriculture. Government must take this evolution into consideration in developing policy. Policy-making must take into consideration the tension that exists between public and private interests. Lien expands the discussion of conflict by arguing that conflict is a two edged sword of public versus corporate, and now a third edge has been added to that sword: that of science (Lien 2004b). That conflict may continue as the food system moves away from the productionist perspective toward the life sciences and ecological paradigms as Lang and Heasman suggest (Lang & Heasman 2005).

Tansey and Worsley believe that conflict in policy-making is inevitable. It arises as a result of the players and their interconnectedness. Government therefore has the responsibility of developing policies that mitigate the risk of those conflicts that will meet the objectives or wishes of its electorate (Tansey & Worsley 2004).

Agriculture and food therefore represent a challenge for policymakers. Tansey and Worsley argue that the political nature of policymaking results in goals and objectives targeting the short term rather than the long term (Tansey & Worsley 2004). Due to its very nature, the agriculture and food sector is not as flexible as other sectors and therefore is challenged to accomplish short term goals.

The literature however cites many goals including economic, social, health, sector development and environmental areas. They incorporate elements and criteria such as food standards, food security, rural sustainability, environmental sustainability, supply controls, protection of markets, trade facilitation, a competitive environment, health (including over and under consumption), employment, nutrition, poverty, transportation, education, science and innovation, intellectual property, localized food systems, etc.

The specific objectives of food policy depend on the region and the various paradigms within the region. Coleman et al. point out that they also take into consideration the values, principles and norms of the society within which they apply (Coleman et al. 2004). Blair is more emphatic. More than just a consideration, he argues that policy must be based on values (Blair 2010).

Barling and Lang speak to the need for policies that enable and promote local food systems (Barling & Lang 2005c). The production and marketing of food products in the local environment addresses social and economic issues of the local economy, as well as reduces the negative impact to the environment of food miles. This concept is in marked contrast to Friedman's 'world is flat' analysis. This concept promotes the economic efficiency driven supply chain to allow for easy access to products and services from around the globe (Friedman 2005).

One of the prominent goals of food policy has been the protection of the public though the focus on setting food standards. Barling and Lang note however that the market has witnessed the takeover of standard setting by the buyer end of the food system – the manufacturers and retailers. These actors are now setting standards increasingly higher beyond those set by public policy-makers. The consequence has been that these standards now act as barriers to market entry for smaller companies and production operations that cannot meet these stringent standards (Barling & Lang 2005a).

Food policy often targets subsidization programs to ensure supply is sufficient and that surplus commodities find markets. While subsidies still are in force in many regions of the world, the move has been for less government intervention in the marketing activities of farm products (Coleman et al. 2004).

Although food security and safety are critical, Cash et al. argue that all public policymaking must be examined *"through a lens of health and nutrition"* (Cash et al. 2004)p. 67 due to the global concern regarding diet related chronic disease and rapidly escalating health care costs. There

appears to be increasing support for this view (Dickinson 2002; Lang & Heasman 2005; Popkin 2003; Schoonover & Muller 2006). Lang et al. however have expanded this concept. They argue that food policy must integrate environment and societal goals with human/population health goals (Lang et al 2009).

Environmental issues are increasingly being put forward to the public. Given the growing concern over climate change, these issues may well capture the primary focus over the development of food policy objectives of the future. Bell offers the example of genetically modified (GM) crops that utilize less water than conventionally grown crops (Executive Education 2006). The World Water Council notes that irrigation for agricultural purposes represents sixty-six percent of global water use but in arid countries, the percentage is an astounding ninety percent (World Water Council 2005). While interest groups are attempting to influence policy-makers against GM crops, the growing scarcity of water in many regions of the world challenges the logic of blanket dismissal of these varieties.

As to the future of food policy, Lang et al. argue that it faces many challenges as it grapples with the growing body of evidence of the impact of the food system on the economic, social and ecological health of people, nations and the globe (Lang et al. 2009)

Innovation policy

Science, technology and innovation policy will be a critical component of meeting the environmental and health objectives of the future. To facilitate science, technology and innovation, Hobbs argues that policymakers must focus their efforts on ensuring a suitable regulatory environment, one that enables the sector and is transparent. She outlines the outcomes of such an environment as the commercialization of safe products, product labelling that allows consumers to make informed choices and legal protection for companies that enjoy intellectual property rights (Hobbs 2002). Coleman et al. agree and note that the protection of intellectual property is one of the requirements of policies focused at enabling the development of innovation (Coleman et al. 2004).

Nelson and Winter support this direction by noting that innovation policy must be designed to enable the development of certain sectors. In addition, they emphasize that since industries and sectors are different, innovation policy must be tailored to each specific one. They argue that policies must aim at "*finding ways to make the currently lagging sectors more progressive, if in fact that can done"* (Nelson & Winter 1977) p.36. It would be interesting to know if these authors categorize the food sector within that realm.

With respect to innovation policy, it has been elevated to forming the core of economic policy for many countries currently. Lopez-Claros et al. argue that innovation policy should not be about picking winners, that is making large investments in a handful of targeted areas, but rather providing an environment that facilitates entrepreneurism and innovation in all sectors of the economy (Lopez-Claros et al. 2006a).

Ezell and Atkinson concur with Lopez-Claros and also note that innovation policy entails policy in more than one discipline. It involves *"elements of science, technology and economic policy that explicitly aim to promote the development, spread, and efficient use of new products, processes, services, and business or organizational models"* (Ezell & Atkinson 2010) p.11. While the expected outcome focuses on improved economic health of a country or organization, Ezell and Atkinson argue that these improvements will benefit the well-being of the citizens or the social welfare of the country (Ezell & Atkinson 2010).

Goodman and Redclift also discuss this domain and argue the source of the conflict is that innovation in the food system has focused on dominating nature to economic interests. This theory of appropriationism is focused on managing the productive capabilities associated with the natural environment. There is uniqueness therefore in the food system agriculture and food/nutrition industry from other industries that limits innovation applications as a result of the conflict and struggle between science and nature. The authors use biotechnology as the prime example noting that it is a transformational technology. In other words, they argue that

biotechnology is a game changer for all actors by *"creating novel life forms"*[4] (Goodman & Redclift 1991) p.167.

As noted previously however, Goodman and Redclift argue that biotechnology is a game changer for all actors, not just at primary production (Goodman & Redclift 1991).
If the food system is considered to encompass non biological sources, then the food sector was deemed to be innovative. The focus of the innovation however focuses on branding, traceability, equipment, packaging and platform technologies.

There is a lack of agreement regarding the concept of innovation or how it pertains to specific sectors. Regardless of where innovation is targeted (e.g. transportation, agriculture, food science, telecommunications, health, etc.), Nelson and Winter argue that the concept of innovation is nebulous. While governments are turning to academics for input into appropriate innovation policy regardless of the sector, Nelson and Winter suggest that scholars lack the appropriate knowledge to offer informed opinions to policy-makers (Nelson & Winter 1977). That claim was made over a quarter of a century ago. The question is whether that claim remains valid.

It is also necessary at this point to distinguish among various policies which are often used interchangeably but are in fact distinct: science, technology and innovation policy. Lundvall and Borras distinguish among the three by stating that science policy focuses on *"production of scientific knowledge"*, technology policy concerns *"advancement and commercialization of sectoral technical knowledge"*, and innovation policy addresses the *"overall innovative performance of the economy"* (Lundvall & Borras 2005) p.629.

Other literature has focused on two approaches to innovation policy: a policy mix approach; and a solutions' led approach.

[4] Health Canada's defintion of Novel Foods is:

- "Foods resulting from a process not previously used for food.
- "Products that do not have a history of safe use as a food.
- "Foods that have been modified by genetic manipulation, also known as genetically modified foods, GM foods, genetically engineered foods or biotechnology-derived foods." (Health Canada)

Flanagan et al. for example argue that the discussion on innovation policy has shifted. The focus is no longer on policy but rather focuses on *"policy complexity and policy co-ordination … the term 'policy mix'" (*Flanagan et al. 2010) p.6 which includes the multiple objectives and policy tools. They argue that the policy mix in relation to innovation is comprised of complex interactions but that little evidence has been gathered to understand the depth and workings of the complexity of innovation policy and its impacts.

Innovation policy has been prescriptive and theoretical in nature largely ignoring the nature and value of the political context in which it operates. They also argue that there is need for a better understanding of the roles of the actors within the realm of innovation policy-making and how their roles can best be utilized. The basis for this argument is the complex, international nature of the actors of innovation, many of which hold significant power or influence in an economy (Flanagan et al. 2010).

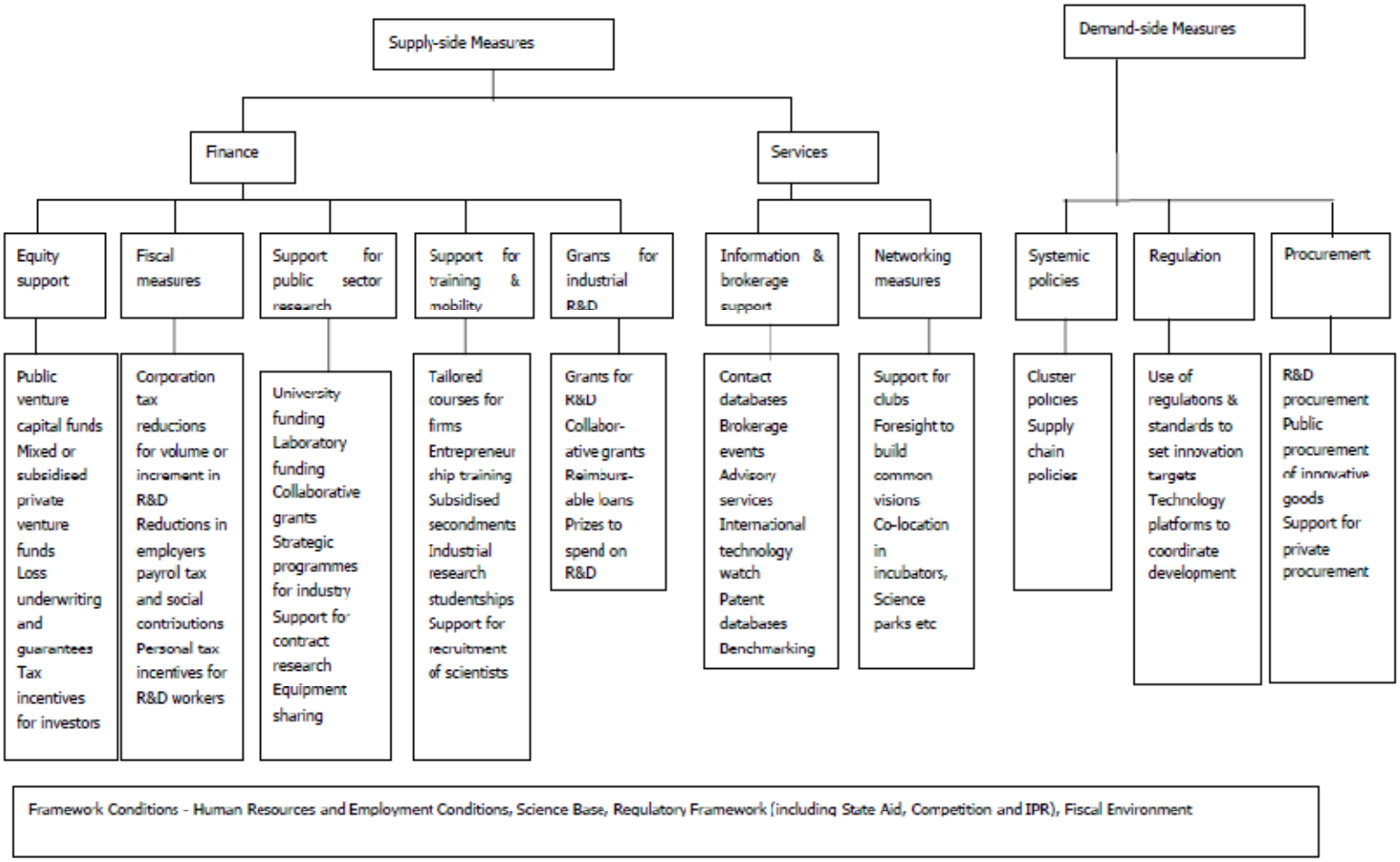
Llerena and Matt concur with these findings. They frame it however somewhat differently. They note that innovation policy must be systemic and dynamic. The dynamic approach must be determined by context and therefore the focus must be on policy design. And policy design must take into consideration the nature of the actors in the innovation system (Llerena & Matt 2005).

Georghiou argues that any policy that supports the growth of innovation activities in the private sector should be considered an innovation policy. The support should be through direct and indirect support. Indirect support includes building an infrastructure that assists in research and development of technology and highly qualified personnel (HQP). Direct support includes financial support to firms (Georghiou 2006). His line of thinking therefore is consistent with the policy-mix or policy design approach.

Georghiou argues that there are two components to innovation policy: 1) supply side; and 2) demand side. Figure 6 on the following page provides an overview of supply and demand side measures in the innovation policy mix. Georghiou argues that demand side policies, particularly public procurement, must be supported to spur innovation at least from a European perspective. Support for the demand side is critical as demand

for innovative goods and services in the marketplace determine the level of investment in research and development by the private sector (Georghiou 2005).

Figure 6: Taxonomy of innovation policies



Source: Georghiou 2006, p.23

With respect to systemic policies, the literature offers a plethora of research regarding cluster analysis. The research has resulted in policy implementation in many regions focusing on the establishment of clusters. Clusters are regionally based and organized around all aspects that support the growth of innovation. They aim to facilitate networking among the actors resulting in greater opportunities to create innovation by transferring knowledge into new products and services (Sala-i-Martin et al. 2010).

Two examples of European clusters are Food Valley, the Netherlands and the Nutrition Health and Longevity Cluster, Lille, France. Food Valley was established in 2004 by the Dutch government with the goal of strengthening the infrastructure supporting innovation to attract foreign direct investment in research and development in the country. The cluster is an example of Etzkowitz's triple helix model with full participation of the government, private sector (both SMEs and MNEs) and academia/research (Hodgins 2010a).

The Nutrition Health and Longevity Cluster (NHLC) was established in 2005 and is part of the Lille Metropole, a designated region in France comprised of five clusters. Similar to Food Valley, each actor group in the triple helix is strongly represented in the cluster. The private sector is represented not only by SMEs but also large and multi-national enterprises including McCain, one of Canada's leading food companies. The company's interest in the cluster is conducting research on the development of new potato varieties that offer enhanced healthy attributes (Hodgins 2010a).

Clusters are equated with regional innovation systems and have been a policy tool targeting economic development (Moulaert & Sekia 2003). While the goal of economic development is still present, the study of clusters has shifted to a focus on knowledge and learning (Lundvall & Borras 1999) as it is now recognized as a major impetus for growth of an economy (Llerena & Matt 2005).

Cotic-Svetina et al. undertook a study that examined the benefits of collective learning within a cluster to determine its correlation with innovation and identify policy implications. The researchers found that the extent of the interaction with local labour was positively related to innovation performance. Interestingly, their study demonstrated that the relationship between interaction with local firms and local institutions is not correlated with a firm's innovation performance. Surprisingly, the

study found that cooperation with local firms impedes innovation (Cotic-Svetina et al. 2008).

The policy implication is that it puts in question the policy focus of strengthening inter-firm co-operation within clusters. They argue that policy programmes should support competition, encourage start-up and spin-offs and ensure that the cluster does not evolve into a closed process but rather encourage international participation in the cluster (Cotic-Svetina et al. 2008). This line of thinking is consistent with the concept of innovation that is about change and evolving systems. The researchers also argue that policy measures should include the establishment of networks outside of the boundary of the local cluster.

They also argue that access to highly qualified personnel and therefore policy should support the development of it by supporting training and education. Programs also need to encourage labour mobility to ensure that knowledge is not institutionalized. But the authors also argue that it is not just knowledge and skills that are required, but the ability for the knowledge workers to absorb the significance of knowledge shared in the cluster and transfer it to the firm's benefit. In other words, policy should also encourage the development of receptor capabilities at the firm level. Policy must set the stage for an open rather than a closed cluster by encouraging linkages with other clusters and organizations (Cotic-Svetina et al. 2008)

Llerena and Matt also support innovation public policy targeting clusters. The goal of policy in this area must focus on knowledge-creation and therefore policy instruments must look to meet that end. The authors argue that policy must explore where gaps exist in the generation and implementation of innovation and support the foundation of innovation which they argue is learning. A policy implication of their argument is that public policy must provide funding for basic research if transformational innovation is to occur. Polices that are weighted heavily at the commercialization of technology, they argue, result in more incremental innovation (Llerena & Matt 2005).

The solutions-led approach to innovation policy is also discussed in the literature. Steward argues that in the past, innovation policy has focused on a science push reflecting a linear model of innovation. The emphasis has been on discovery and the commercialization or introduction into use of the discovery. As a result, policy has favoured the large corporate actors who have the capacity and capability to participate in that model. Steward argues however that the model requires changing

to what he terms in his inaugural address at Brunel University as “challenged led” (Steward 2010a). The policies he stresses must be more solution oriented and have goals that target societal outcomes. While the context for his address was climate change, he spoke of innovation policy requiring a systems or holistic approach where a variety of innovations, some small, others large, enacted by a diverse array of actors, join together to create the change (Steward 2010a).

Smith et al. concur with this approach and note that the outputs and outcomes of innovation are constrained by *“overarching structures of markets, patterns of final consumer demand, institution and regulatory systems and inadequate infrastructure for change”* (Smith et al. 2005) p.1491. While their study focused on green energy sources, they point out that the challenge for policy-makers, both public and private, is to take a solutions-led approach and transform the entire system, in their case green energy for the more rapid uptake of innovation that provides benefit sought.

Their approach therefore is not only about policy that provides an environment that enables innovation but also about transforming the market and infrastructure that allows for a more rapid diffusion of the outputs of innovation. Therefore policy must reflect not only innovation at the micro level but must be combined at the macro level which they term systems innovation (Smith et al. 2005) p.1492.

This argument is consistent with that proposed by Lang et al. in the area of food policy. They argue for a solutions’ led approach to food where health, social and environmental outcomes are combined. They also call for a combined effort in public and private policy to enact this change (Lang et al. 2009). It appears that they are calling for systems innovation in food policy.

The literature has demonstrated that there is agreement of the growing complexity and interconnectedness of problems and issues facing policy-makers. Innovation is likely to be at foundation of dealing with many of these complex issues. Steward argues that a solutions-driven approach to innovation is required (Steward 2010a). Smith et al. agree and argue for a more holistic approach to innovation which includes dialogue among a much wider array of actors (Smith et al. 2005).

Regardless of which policy is enacted upon, Ezell and Atkinson argue that innovation policy should be measured against a framework of who benefits from the policy.

Their framework is entitled *"the good, the bad, the ugly and the self-destructive of innovation policy"* as depicted below (Ezell & Atkinson 2010).

Table 2: The good, the bad, the ugly, and the self-destructive of innovation policy

		World	
		Wins	Loses
Country	Wins	Good	Ugly
	Loses	Self-Destructive	Bad

Source: Ezell & Atkinson 2010 (p.7)

The framework argues that only innovation policies that positively impact or provide benefit to both the country (enacting the policy) and the world should be considered good policy.

1.3.3 Influences on policymaking

Drivers of food and/or agriculture policy have changed over the last century. The First Food Regime (1870-1950) was driven by the state and the need to build nations. Since that time the driver has passed from the processors in the Second Food Regime (1950-2000) to the retailers of Third Food Regime (2000-present) (Burch & Lawrence 2005).

As the drivers have changed, so have the policies. They have evolved from the proactive policies of the First Food Regime to the reactive policies of the current regime. As such, policy reacts to specific influences. Those influences identified in the literature regarding agriculture and food policy in general include public opinion, partisan politics, corporate action, globalization, culture and crises.

Public opinion is one of the primary drivers of policy (Baber 2005; Burstein 2006; John 1998; Lien 2004a; Lien 2004b). Burstein argues that the impact of public opinion on policy-making is so strong that it can override the intentions of the ruling political party and/or the opinions of experts (Burstein 2006). The current public outcry about health (Barling & Lang 2005a) and the environment (Lang & Heasman 2005) are already seeing major policy activity whether it be resource allocation for funding to scientists for specific areas of research such as genomics, nutrition, biodiesel, etc., or the development of multilateral policies such as the Kyoto Accord.

Public opinion not only influences public policy but also corporate policy. The public's concern over the use of trans fats in the food processing sector has led to changes. Kentucky Fried Chicken for example announced on October 30, 2006 that it would phase in the use of canola oil rather than use trans fats (KFC Press Release 2006) to fry its world famous fried chicken.

As noted above, policy is about politics and as such policy is driven by the political party in power. Coleman et al. argue that should a political party receive its mandate from urban centres rather than rural areas, it is more likely to target policies at agricultural reform (Coleman et al. 2004).

Corporations have also driven policy. Barling and Lang note that governments have lagged behind large and global retailers in setting standards resulting in power and control being seized by the retailers (Barling & Lang 2005b; Burch & Lawrence 2005; Lang & Heasman 2005). Corporations have been able to drive policy due to their increasing size and power within the global arena. These corporations have taken advantage of the velocity of change of technology that has allowed them to seize the power (Lang & Heasman 2005).

Globalization is also driving policy. Events in one region of a country or the world will often impact other regions. In addition, the movement of food from one region to another involves at least two if not more countries. The result is a transnational policy environment where countries are working together to develop policies that impact its member states (Barling & Lang 2005b; Coleman et al. 2004) in order to reduce barriers to trade and ease foreign direct investment (Pritchard & Burch 2003). The World Trade Organization and Codex Alimentarius Commission are two examples of cooperative actions among nations to address issues of food safety and trade.

Goodman also identifies the issue of globalization in the sense of global competition and quest for global leadership. The impact has been the development of new alliances between and among nations and corporations for many purposes, among which is policy development (Goodman 1997).

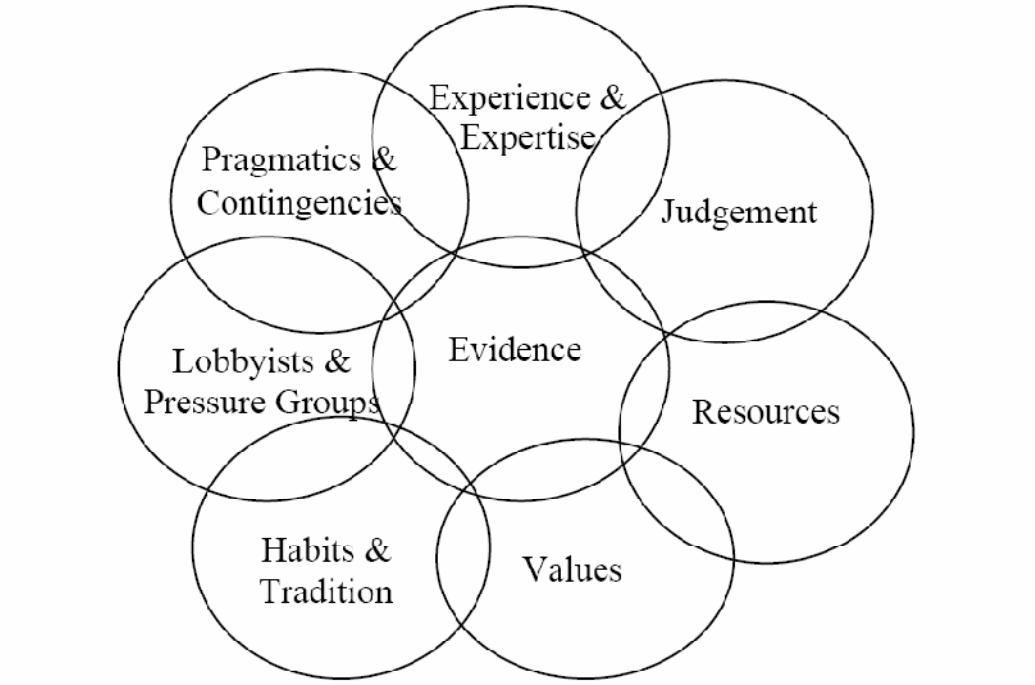
Culture also plays a role in driving policy. Coleman et al. argue that population migration has resulted in the shifting and blending of cultures in non traditional

regions resulting in movement of food products to other regions (Coleman et al. 2004) to satisfy the demands for flavours and products from various homelands.

Crises have also driven policies that affect the food system. Natural disasters such as the prolonged drought affecting Australia and its food production are part of the cycle of agriculture. Policies focused at risk management measures are therefore put in place to assist the farming community under stress. Crises such as threats to human health have also driven policy whether the case is BSE in Britain or Avian Influenza in Canada.

With respect to evidence-based policy-making in general, Figure 7 below provides an overview of the factors Davies argues that influence policy-making. Interestingly, at the centre of his model is evidence. While he argues that it should lay the foundation for decision-making, he identifies other factors that weigh heavily on the process. He argues that under the current political environment, these factors will not likely change and so must be given consideration in an evolving model for evidence-based policy-making (Davies 2004).

Figure 7: Factors influencing policy-making in government



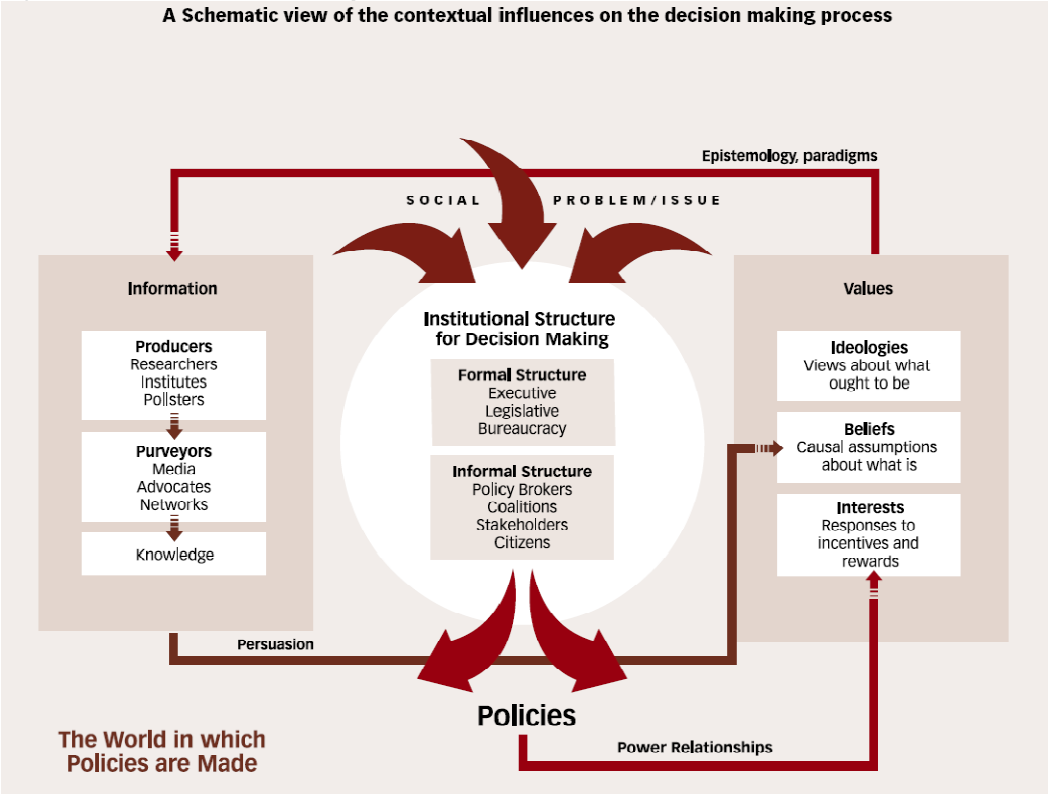
Source: Davies 2004 p.7

Davies points particularly to the tension between values and sound evidence. He encompasses political ideology and beliefs in his discussion regarding values. He argues that this tension will continue and must be a practical consideration under the system of modern governance (Davies 2004). Zussman as well as Davies support this argument adding that the political tension may in fact inhibit any decision being made regarding evidence presented (Davies 2004; Zussman 2003).

Lomas adds to the discussion by identifying the various influences of the decision making process. He offers a different context regarding influences as outlined in Figure 8. His framework offers a conceptual view of who and what influences the outcome of the process and the policy instrument that is implemented to address a problem or issue. The framework is intended to provide context for all actors, and in particular the research community to gain a better understanding of the context within which decision-making is undertaken and therefore the kind of information that is best utilized (Lomas 2000).

Within the framework, Lomas identifies two key influences on the actors: 1) information, and 2) values. While these are in line with Davies factors, there are some key differences. Lomas notes that information is more than research based evidence. It relates to a broad body of data and sources that inform the decision making process such as research, media reports, anecdotes, etc. They provide context for decisions to be made. The key is that researchers are not the only source of information considered. This is particularly important when considering the evidence-based model of policy-making (Lomas 2000). The additional difference is resources. While Davies specifically identifies resources and their ability to impact the decision-making process, Lomas makes no mention of this aspect.

Figure 8: The world in which policies are made



Source: Lomas 2000

The other key influence on decision making is values. As indicated in the diagram above, values are comprised of three components, ideologies, beliefs and interests. Lomas argues that research must target beliefs to influence change. Beliefs underlie the assumptions made about the problem or issue targeted by the specific policy-making process and are more open to change than ideologies (Lomas 2000).

Parsons also discusses the role of values in policy-making. He argues that the evidence-based approach devalues the belief system upon which government and in particular the political arm is based. The approach values effectiveness over other issues which are of equal importance. Parsons argues that policy-making must provide a platform for dialogue that includes evidence which considers ethical stances (Parsons 2002).

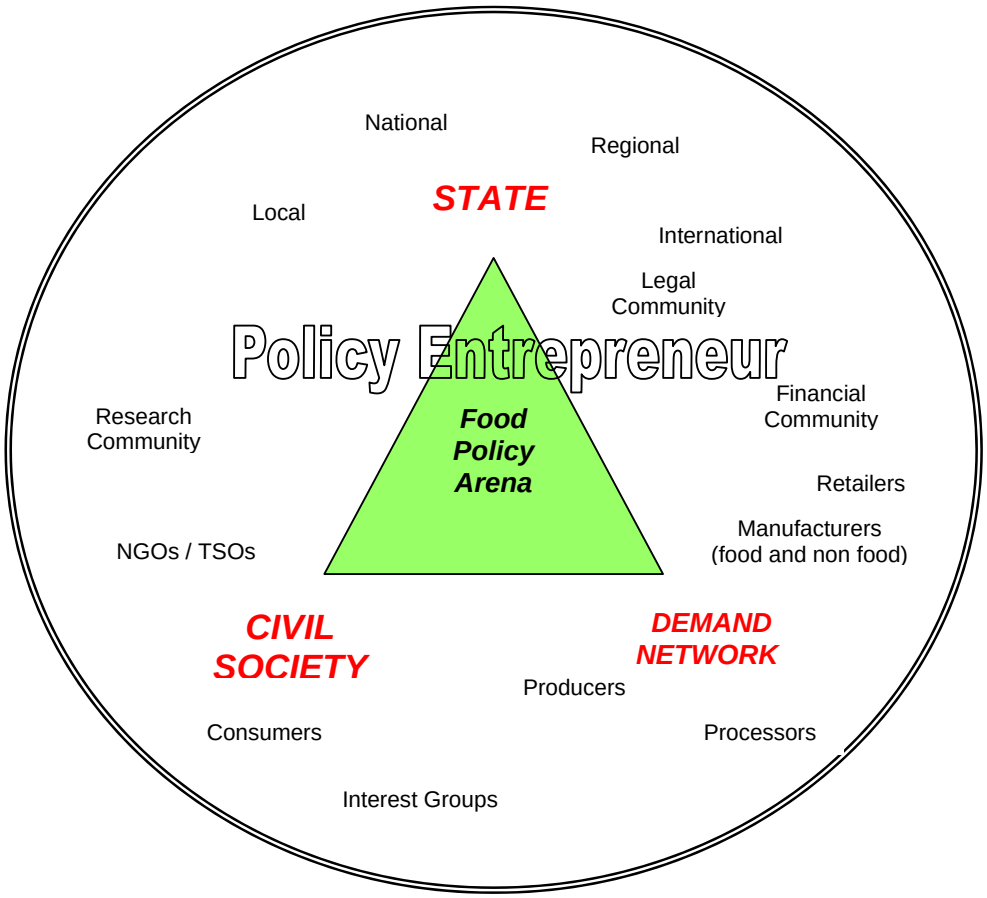
Head also weighs into this area. He argues that policy issues where there are conflicting values or tension among actors are more likely to be determined less on evidence and more from the viewpoint of political ideologies. He adds that role of evidence is diminished in favour of the political influence in issues that are *"subject to*

rapid change" p.81 where time does not allow for the gathering of evidence (Head 2010).

1.3.4 Actors

Actors in the policy environment are generally described in three areas: civil society, the state and the supply chain (Barling & Lang 2005a). Figure 9 is adapted from Barling and Lang and identifies the actors within each of the three general categories and as it applies to food policy.

Figure 9: Actors in the food policy arena



Adapted: (Barling & Lang 2005c)

The actors however operate within a complex web dependent on each other to address specific issues.

The State

Pentney argues that the role of government is to listen and respond (Pentney 2006). The response is in the form of policies that are in the public interest. And as identified in the previous section, the public interest envelopes not only the general population but also corporate interests.

The issue of intellectual property is a primary concern to corporations operating within the global community (Coleman et al. 2004; Hobbs 2002; Lopez-Claros et al. 2006). As the pressure for innovation in the food system increases to provide solutions for health and the environment, corporations and the financial/investment community will be looking to nation states to ensure that intellectual property rights are protected internationally.

Nation states must also take into consideration the policies of the global community and the member organizations to which nations are committed such as the World Trade Organization, the United Nations, Codex Alimentarius, the European Union, the North American Free Trade Agreement, etc. These organizations not only provide rights for the member nation states but also responsibilities for complying with the policies set out in the international organization.

Lang and Heasman argue that nation states are forced into a balancing act when making policy. They must satisfy local demands but also live up to the spirit if not the letter of the policies to which they committed in the global arena (Lang & Heasman 2005). The two constituencies may have diametrically opposed expectations thus increasing tensions.

Policy-making within the state must also take into considered the multi-levels of government. The division of power among the various levels of government such as municipal, regional, provincial, territorial, state and federal jurisdictions can be problematic. Tension often exists as a result of the division of power, limited and unbalanced resources and analytical capacity which are often conflicting (Head 2010; Howlett 2009; Davies 2004).

Employment is also a major issue for the state actor. The impact of the power shift in agri-business therefore is of utmost concern for governments as they look for employment opportunities for their population (Murphy 2006). While global and

corporate power shifts in the food system have reduced the areas in which the state can influence, undoubtedly government is concerned about employment. Governments are looking to innovation as being one method of keeping jobs at home. The rate of innovation and its impact on employment outcomes is a major consideration in the development of innovation policy (Nelson & Winter 1977).

While the state faces many issues in its role, Coleman et al. suggest that further exploration of the context of the state in policy-making is required. Policy issues in the past with respect to the food system were negotiated between Ministries of Agriculture within and among nation states. Other ministries are now included in policy debates such as ministries responsible for trade, health, environment, finance, commerce, etc. (Coleman et al. 2004). The additional players at the table can add conflict and competition for scarce resources of government.

With respect to evidence-based policy-making, the final factor is receiving attention in the literature, that of analytical capacity within government. Evidence-based policy assumes that those who set policy in government have the capacity to analyze the research provided and assess its implications.

Capacity is defined by Zussman as "*the research and analytical skills to seek out and analyse information with respect to various policy options … to understand the limitations of the evidence and to make reasonable inferences based on incomplete information … ability to integrate that scientific kind of evidence with the soft but very powerful evidence"* (Zussman 2003) p.70. The literature argues that analytical capacity is lacking in government in developed nations (Head 2010; Howlett 2009; Howlett & Newman 2010; Zussman 2003). Howlett also argues that it is low in non-government actors including at the political level as well (Howlett 2009). The implication is that even if evidence could be useful, if the analytical skills are not present to understand and incorporate the findings, the lack of analytic capacity limits the potential use of evidence in policy-making.

Omand et al. offer an additional perspective. Their research suggests that policy must take into consideration the experience of the civil servants. They argue that these actors not only work with the researchers but also the public, the users of a particular government services. They argue that as such, these workers have experience that must be garnered and is critical to the policy-making process as they

have practical insight into the types of policies that will produce the intended results (Omand et al. 2000).

Policy-makers therefore face a plethora of issues. In addition, limited resources may pose the greatest challenge. They must consider the Rule of Proportionality. Based on the policy issue, policy-makers must allocate resources appropriately (Pentney 2006) often putting sectors of the economy and the social outcome goals in competition with each other. The other challenge for government in setting policy is to find the right balance between risk and benefit of a policy. Cash et al. pose the dilemma of governments setting health promotion policies that entice the population to consume healthy products on the one hand, but restrict or limit the ability of companies to promote health benefits of their products (Cash et al. 2004).

Supply Chain

The large corporations have gained power in the international environment (Barling & Lang 2005b; Fold & Pritchard 2005) and thus the policy arena resulting in a weakening of the power of the nation state. Goodman argues however that both actors have a co-dependent relationship to meet their respective objectives. Corporations and the state are entwined in an ever changing but necessary alliance (Goodman 1997). This observation also demonstrates the interconnectedness within policymaking as identified previously.

Friedmann and McMichael however cast a different view. They argue that the transnational corporations operating within the food system have captured control of the system and thus have reduced the policy-making box within which nations expect to operate (Friedmann & McMichael 1989).

Steward argues that the large corporate actors continue to have significant power in policy-making particularly in reference to innovation policy. Their interests have been at stake and they have seized the power to continue their influence to enhance corporate benefit from the policy-making process. He argues however under the new challenge led framework for innovation, that a more diverse set of actors should provide input into policy-making. He calls for dialogue and policy that weighs the input and interests of civil society, smaller scaled innovators and local actors to be considered over that of the larger corporate interests (Steward 2010a).

Much of the literature regarding policy focuses on public policy rather than corporate policy. Lang and Heasman as well as Lang et al. note that within the food system, public and corporate policies are not synchronized. In other words, they are often working at cross purposes (Lang & Heasman 2004; Lang et al. 2009) for example the health of the nation versus the economic interests of industry.

A consistent theme in the literature regarding evidence-based policy-making is the need for discourse with stakeholders or various actor groups (Choi et al. 2005; Davies 2004; Howlett 2009; Lang et al. 2009; Lomas 2000; Omand et al. 2009; Parsons 2002; Russell and Greenhalgh 2009). The challenge of such discourse is to ensure that it reflects a dialogue approach or the process can devolve into what Davies terms GOBSATT (*"good old boys sitting around talking turkey"*) (Davies 2004) p.10.

Civil Society

Civil society is represented by not only the public but also by non government (NGO), not-for-profit groups.

The public plays a crucial role in policy-making. The previous section identified the key impact of public opinion on policy-making (Burstein 2006; Pentney 2006). The interconnectedness of the actors within the policy-making arena, the complex nature of issues and interpretation of the evidence all affect the public's participation in policy-making. Lien suggests that consumers recognize the difficulty in being informed on issues (Lien 2004b) often exacerbated by the conflicting evidence put before them by the experts. Conflicting evidence often arises within the context of science and technology.

Science and technology are often considered to be at the heart of innovation. Felt and Fochler point out that policy-makers and those charged with the governance of science have promoted the importance of public engagement in the process. They argue that how the process of engagement is to be accomplished and the goals of it have not been conceptualized well (Felt & Fochler 2008). This point is particularly challenging for not only civil society but also government when scientific breakthroughs or new domains are discovered. There is often a time lag from the time of the discovery to the point where policy-makers and indeed the public can grasp the understanding of the science or at the very least its implications.

Policy-makers are increasingly challenged by the impact of an ill-informed public. In order to gain the trust of the public, they may be reticent to actually make decisions or be slow to do so. The result could be an overly cautious, risk-averse policy arena that prevents the public from deriving benefit from proposed policies. The debate on the appropriate balance between risk and reward becomes hindered and prolonged (Pentney 2006). As a result, NGOs are taking the place of the public in providing informed opinion on issues and proposed policies.

NGOs including social movement organizations are seizing their place in the transnational policy space (Coleman et al. 2004). Casey argues however that the impact of advocacy activities by third sector organizations (TSOs) or NGOs is unknown and is dependent on the nature of the issue, the environment, the TSO and its network with other actors in the sector in which it operates (Casey 2004). The influence of NGOs/TSOs on the policy environment within the food system therefore must be monitored and measured.

The research community (excluding the in-house corporate researchers) also plays an important part of civil society. This group finds its home in academia or government sponsored research facilities. As a result of the demand for evidence in the policy-making process (Barling & Lang 2005a; Cable 2003; Cash et al. 2004; Howlett & Newman 2010; Lang 2010; Lang & Heasman 2005; Lang et al. 2009; Lomas 2000; Marston & Watts 2003; Omand et al. 2009; Osborn 2006; Russell & Greenhalgh 2009; Zussman 2003) this group (i.e. experts) plays an important role in the food policy arena. Due to the diverse and increasingly complex and specialized technical, ethical, and legal issues, policy-makers will be turning to recognized experts in their fields for input into diverse and unexpected areas (Coleman et al. 2004; John 1998).

The challenge for the experts will be to provide advice based on unbiased research and research that it is perceived to be unbiased. If private corporations fund research conducted at public institutions such as a university, will the evidence developed by the researcher be deemed to be tainted? In the era of increasing budget constraints, this issue will come to the forefront of evidence-based policy-making.

The Policy Entrepreneur

Another actor in the policy environment, one that cuts across the typical triumvirate of state, civil society and supply chain has emerged.

John argues for the need for a new actor, what he terms a policy entrepreneur. This actor can rise from the ranks of the state, civil society or the supply chain. A policy entrepreneur possesses the passion and energy of entrepreneurs but his/her goal is to resolve an issues or problem of interest to the public (John 1998). The need for such an advocate has emerged due to the complexity of issues and new concepts that arise to address these areas of public concern. One might argue that Al Gore is a policy entrepreneur with respect to climate change. He has been relentless over a number of decades in pushing environmental issues to the forefront and more recently gained wide-spread recognition and the 2007 Nobel Peace Prize for his work in the area.

1.3.5 Interaction among the players

Depending on the policy issue at hand, the actors who receive benefit or are impacted by the policy issue seek influence in the political policy-making process. This process is denoted as being a democratic process (Lang & Heasman 2005). As such it is seen to be one of negotiation among the actors (John 1998; Krahmann 2003). Based on the issue and scope of the policy, any number of the actors will move in and out the arena to conduct the negotiation.

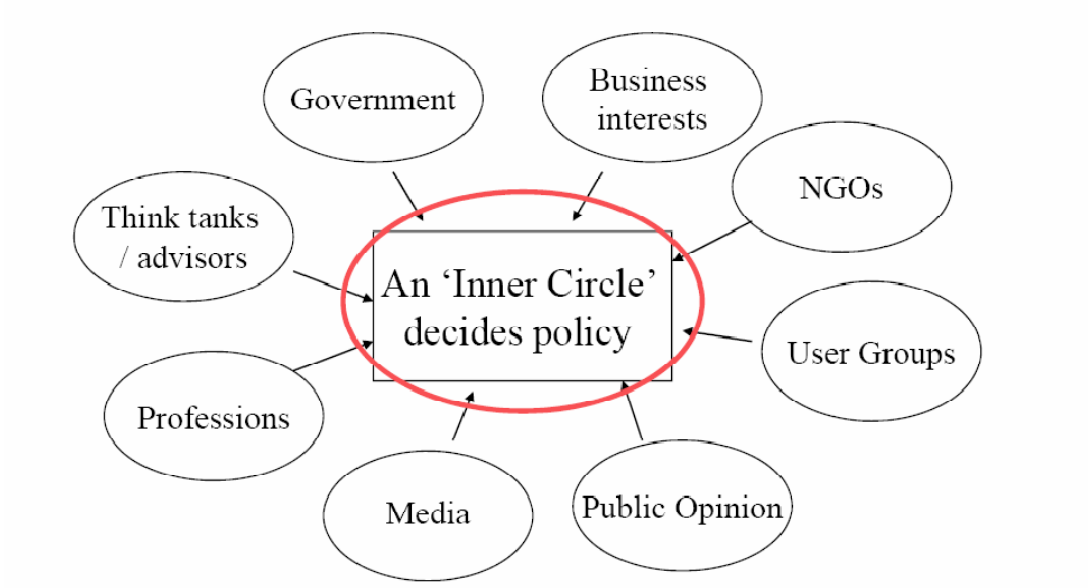
Regardless of the number, expanse or scope of the actors involved, tension often exists among them. Barling and Lang offer the example of public versus private sector standards, where producers or companies can often meet the publicly set standards (e.g. Codex Alimentarius Inc.) but are unable to meet the standards of a global retailer (Barling & Lang 2005b).

Tensions are not always negative and can open up opportunities. In the case of the food system, Lang and Heasman argue that a common vision is required that could result in opportunities opening for each member of the network (Lang & Heasman 2005). Systems innovation could address this concern, where all actors participate in working toward and implementing public and private policies that are solutions-led (Smith et al. 2005).

It is likely that just as the power within the food system is dynamic, the actor(s) who have influence if not power in policy-making will also change in the future. While the power of the global retail community is likely to continue for the foreseeable future, concern over the environment, climate change and societal issues is already increasing. For example, since agriculture is the major user of water and land, more attention will be drawn to this sector of the economy with environmentalists and researchers moving into centre stage of the food policy arena.

With respect to evidence-based policy-making, the critics argue that there are political realities that come into play and not enough credence is given the contextual tension and influences among the actors. As Lang illustrates in the figure below, actor theory demonstrates that the organization, and in the case of public policy, government, actually makes the decision regarding policy. Tension exists among the actors as they compete to have their interests represented in policy (Lang 2010).

Figure 10: Actor theory: a competition for influence - inner/outer circles



Source: Lang 2010

Conway and Steward expand the actor theory and discuss actor network theory (ANT) and its applicability to innovation. They argue that ANT not only concerns the dynamic interrelationships of the actors in the network but also the dynamic roles they play and the political nature of the network. As well, the differentiating feature in

ANT to actor theory is that *"intermediaries"* (Conway & Steward 2009) p.80 such as technology are granted the same standing as other actors. The technological component is deemed as significant to innovation and science as the human element. The actors in these networks individually and collectively influence policy.

Smith et al. argue that actors can have significant power and influence in public policy-making and can set direction of the entire governance of the regime (Smith et al. 2005). There is support for this argument in the literature (Goodman & Redclift 1991; Lang et al. 2009; Lien 2004; Steward 2010a). Steward is even more specific and states that large corporations have demonstrated significant power with respect to innovation policy under the science-push model (Steward 2010a).

1.3.6 Impact of policymaking

As Tansey and Worsley point out, the issue of who benefits from any policy is determined by analyzing who holds the *"power, influence and control"* over the system (Tansey & Worsley 2004) p. 215. Currently, power has shifted to the multinationals as noted above. In addition, there is a complex group of actors who influence policy-making. And while policy is meant to address issues facing the public, the public is confused about the conflicting information it receives from the perceived experts.

As well and of perhaps greater concern is that policy-making is often undertaken in silos or with little consideration to a large vision, if indeed one exists (Cash 2004; Lang & Heasman 2005). Policy-making targeting visions that are no longer relevant are also of concern. Segal points to path dependency, a theory that suggests that it is easier to follow the same pathway rather than set out on a new course. By doing so, policy-makers in fact open the object of the policy to greater risk than if a new course had been chartered (Segal 2006). The result can be a sector that is less competitive than its international counterparts.

As a result, policy-making is often perceived as being 'piecemeal', addressing only one or a few components of a larger issue. These approaches have resulted in policies with unintended consequence resulting in a negative impact (Cash et al. 2004). For example, subsidies provided to the large sugar producers are a case in point. According to the documentary *'Big Sugar'*, cheap raw material (i.e. subsidized sugar production) led to the production of a mass of food products that are filled with empty calories (calories having little or no nutrient value). The products are relatively

inexpensive offering an economic benefit to consumers as compared to healthier fresh foods but have been credited with being a major contributor to the global obesity crisis (McKenna 2006).

Von Braun and Pandya-Lorch support the conclusion that policy-making is often piecemeal. They suggest that agriculture and public health policies are typically developed with little consideration to goals or potential impacts in each area. In addition to, or instead of, unintended consequences, missed opportunities can occur. The authors point to the opportunity of addressing poverty which has been proven to be impacted by health which in turn is impacted by diet (von Braun & Pandya-Lorch 2006).

The lack of cohesion and vision among policymakers and the various actors has manifested into a slow translation of evidence (natural and social) into policies that benefit the public. The literature argues that the uptake and impact of evidence to date is limited at best (Head 2010; Howlett 2009; Lang et al. 2009; Omand et al. 2009; Parsons 2002). An example is the late market introduction of Benecol into the market for the benefit of the population. Green et al. describe the evidence of health benefits derived from plant sterols, developed in the 1950s, in reducing cholesterol. Commercialization of the compound into a food product was not accomplished until forty years later when Raisio introduced Benecol to the market. An integrated approach among the actors at the outset would have resulted in earlier commercial uptake of the compound. Essentially the authors argue that such an integrated approach is required to translate science and knowledge to the benefit of society (Green et al. 2006).

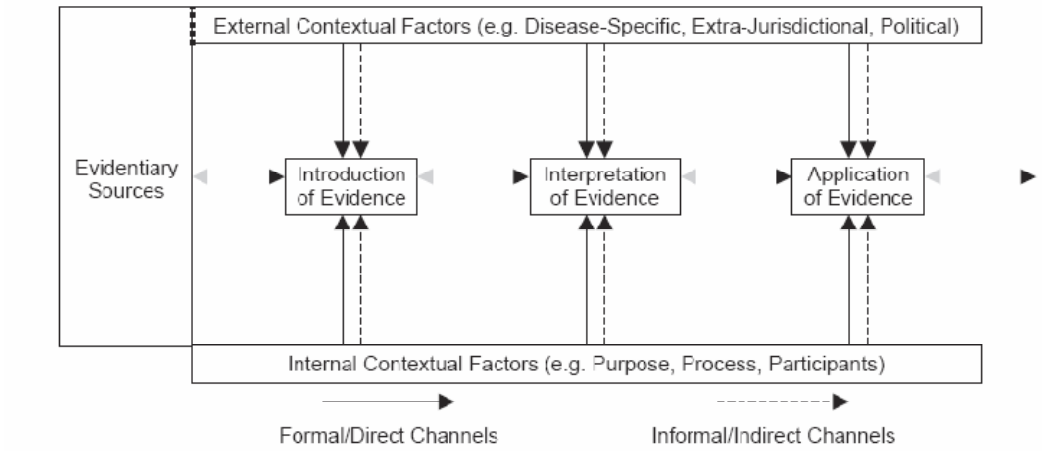
With increasing scientific discoveries, policy-makers will need to find a way to balance the risk and reward for both corporations and the public. Murphy supports this view by offering that public policy-makers must address national competition policy to ensure that both corporate and public interests are weighed (Murphy 2006).

Regardless of whether discussing innovation policy or food policy, the foundation of policy and how it is formed are critical. The literature review on the subject matter demonstrated that evidence should still be considered an important component of policy-making. Rather than being the cornerstone of policy however, evidence is meant to inform policy-making (Head 2010; Lang 2010). It is meant to contribute to policy rather than being its sole basis (Millstone 2004).

The literature indicates strong support therefore for an evolution in evidence-based policy-making. One argument focuses on a context-based, evidence-based approach. The other combines evidence and experience.

Dobrow et al. outline their framework for context-based, evidence-based policy-making. The figure below provides a pictorial overview of the concept. The framework recognizes the internal and external considerations that comprise context and impact decision-making (Dobrow et al. 2004). The framework keeps evidence at the core but ensures that context is incorporated at all stages of the process. It also complements well, Figure 7 which outlines Lomas' schematic view of the contextual influences on the decision-making process.

Figure 11: Conceptual framework for context-based, evidence-based decision-making



Source: Dobrow et al. (2004) p.216

This approach appears plausible given the reality of the growing complexities of issues and relationships faced by policy-makers. One downside of Dobrow et al.'s overview is that the primary emphasis remains on evidence. Depending on the issue, evidence however may play a minor role in any decision taken. For example, political ideologies may be the primary consideration in some circumstances.

The other challenge in Dobrow et al.'s depiction is that the interpretation and application of evidence is central. The literature shows that policy-makers often lack the analytical capacity to undertake these activities appropriately (Head 2010; Howlett 2009; Howlett & Newman 2010; Zussman 2003).

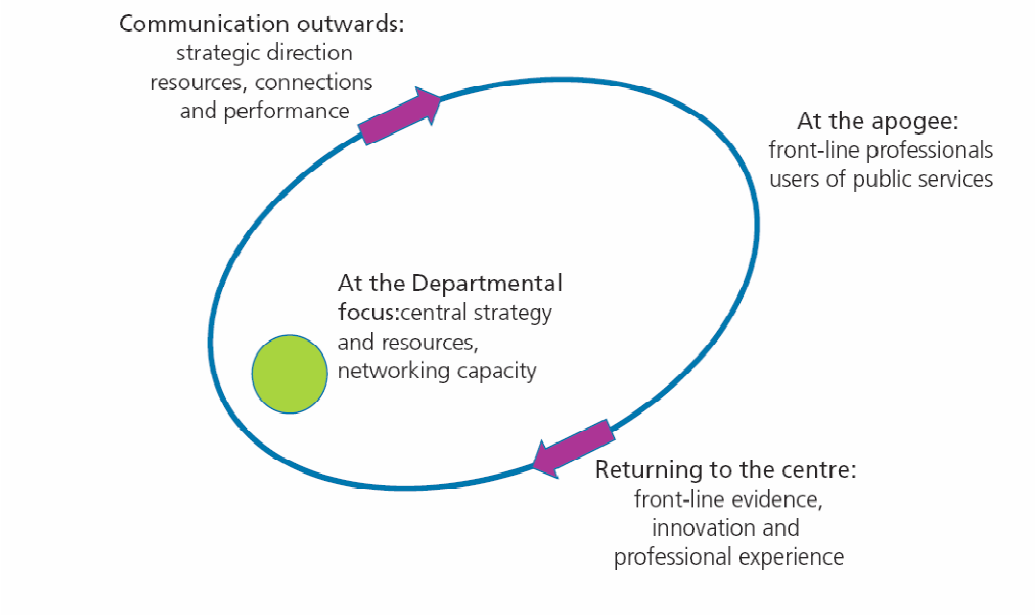
Marsten and Watts as well as Lomas support the notion of contextual policy-making (Lomas 2000; Marsten and Watts 2003). Lomas argues that a sound contextual understanding increases the likelihood of influence of researchers and their work in the development of policy. The implication is that the stronger the linkages among the actors of a particular sector, the higher the level of influence in policy-making, and the higher the likelihood that policy will be set that is based in evidence as well as context (Lomas 2000).

Flanagan et al. would appear to be in alignment with this model as well. They argue it however from a unique perspective. They argue that innovation policy has been heavily reliant on theory and evidence without the input and dialogue of the political element (Flanagan et al. 2010). The criticism is often that policy lacks the contribution of non government actors, rather than the political arm of government.

Lang also offers a caution. The growing complex nature of issues and policy-making requires that constant monitoring and understanding across disciplines is continually required and input sought across the disciplines. He also cautions that demands are such that often there is insufficient time to gather the evidence required to make decisions in developing and enacting public policy (Lang 2010). Zussman agrees with Lang's points but he adds that in other instances, there may be time to gather the evidence but lack the time to put it into context and understand the implications of the evidence (Zussman 2003). Both authors point to the reality of time constraints. The implication is that more weight may be given to context than evidence or vice versa by default.

The second model is proposed by Omand et al. They propose "*the Apogge Approach (Aspiring to Policy that is Grounded in Evidence and Experience)"* (Omand et al. 2009) p.7 as depicted in Figure 12 below.

Figure 12: The Apogee approach



Source: Omand et al. 2009 p.7

The Apogee Approach places key importance on the experience of the civil servants particularly those who deal directly with other actor groups and stakeholders. This model focuses on the knowledge and experience of this group noting that the networking and engagement with stakeholders and sources of evidence place them in an ideal situation to provide the input required in the internal process of policy-making. This approach argues that the civil servants have the practical insight into the types of policies that will produce the intended results (Omand et al. 2000).

1.4 Conclusion

This chapter examined a framework to assess an innovation policy environment and specifically as it relates to segments of the food system.

The argument has been put forward that supply chains operating in the food system have evolved to being complex demand networks attracting non traditional actors. These new networks are also networked with systems of innovation targeting the food system. These systems of innovation, similar to the demand networks of the food system, are complex, involving local, regional and global actors and institutions resulting in complicated, interconnected function (innovation) and form (food system) networks. The implication is that policy support must be multi-dimensional in nature.

As public decision-makers explore policies that enable innovation in their constituencies, they are faced with the challenge of capturing benefit from these globalized networks. The challenge is how to derive benefit from public support in innovation when it may be extracted in other regions that also participate in the innovation system.

This chapter also illustrated a shift in thinking regarding policy-making. The latter part of the last century called for policy to be founded in evidence. The literature of the past decade however has shifted to recognition of other factors. While evidence is important, academics now support the notion that it should not be considered the sole basis of policy but rather placed in context of internal and external factors affecting it.

With respect to innovation, public policy-makers have focused on economic returns. There is growing call to incorporate societal goals as well. Academics have pointed to the necessity of dialogue regarding values and goals upon which policy-making is based.

The chapter also described that even though all actors are actively participating in innovation, there remains a lack of common understanding of the concept. The challenge for policy-makers is where support should be given for innovation. If it is perceived to be an outcome, then policies are likely to focus on downstream commercialization activities. If policies are based on the innovation as systems that create knowledge, then basic research may receive more support from polices.

CHAPTER TWO – Canada: the agri-food system, innovation and policy

2.0 INTRODUCTION

Chapter Two applies the concepts outlined in Chapter One as they pertain specifically to the Canadian agri-food system. There are four core arguments presented.

The first argument is that the Canadian food system is complex and follows the global trend towards demand networks supplanting supply chains. These demand networks support the shift that is occurring in the food system in the country to a focus on the bioeconomy, a sector that is founded on innovation.

The second core argument is that similar to findings from Chapter One, there is no common agreement on the concept of innovation in Canada. While there is a lack of agreement on what it is, the literature argues that it is required for Canada to realize economic benefit. Regardless, the current consensus is that Canada is falling behind other countries with respect to innovation which puts at risk the well-being of the country and the food system specifically.

While significant public investment has been made in innovation in Canada, it has not translated into significant benefit for the country or its citizens. The shift from an innovation strategy to a Science and Technology Strategy has resulted in the focus of innovation at near market commercialization activity, away from basic research causing tension between the academic actor group and government policy-makers.

Policy-making itself is challenged in Canada. The third core argument is that Canada's multi-jurisdictional system has resulted in different agendas and tension among the jurisdictions. It also argues that the disperse nature of policy-making has resulted in Canada's analytical capacity lacking particularly at the provincial and territorial levels. This point has significant negative implications with respect to context-based, evidence-based policy-making.

The fourth core argument is that change is required in Canada. The literature is consistent in its call for change. Change is called for in a shift of a vision for the food system. It is based on dialogue with all actors in the policy-making arena, including the citizens. It envisions Canada as a healthy nation. The call is for new policies in

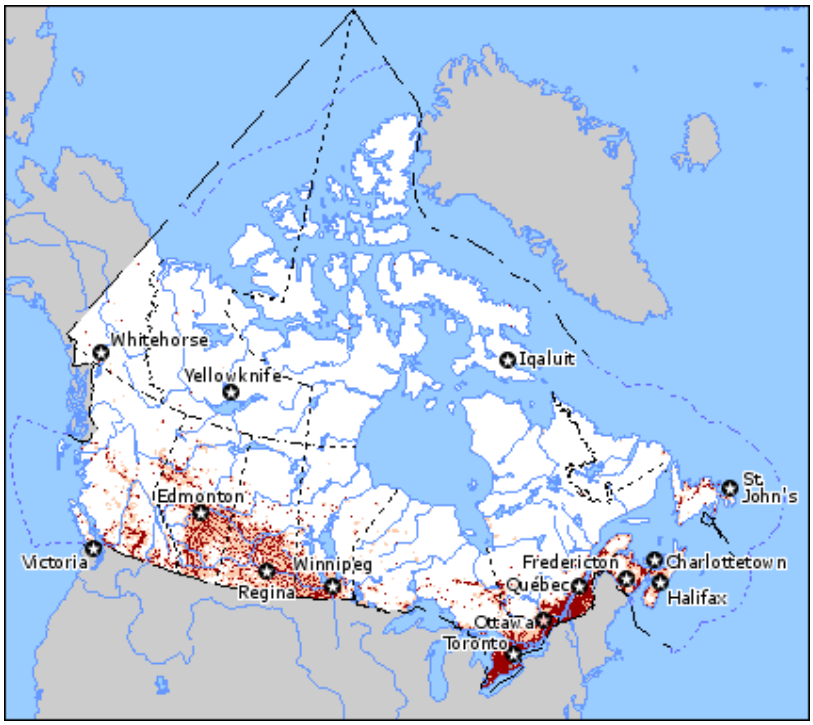
innovation as well as a national food strategy, one that has been nonexistent to this point in time.

2.1 The Canadian Profile

Canada is the second largest nation in the world occupying 9,012,112.20 square kilometres of territory. The country is comprised of ten provinces and three territories. The territories (Yukon, Northwest Territories and Nunavut) guard Canada's northern frontier and are sparsely populated. Statistics Canada estimates that Canada's population is 34,019,000 as of April 1, 2010 (Statistics Canada 2010a).

The following map illustrates that the majority of the population live within a band close to the '49th parallel' to which the border it shares with the United States is commonly referred. In fact that area is home to ninety percent of the country's population.

Map 1: The Canadian landscape



Source: Natural Resources Canada 2010

Trends affecting Canada are not dissimilar to those facing other developed nations. They include an aging population, concern over the environment, rising health care costs, technological change, globalization, consolidation throughout the entire supply chain and rural depopulation (Beaudin 2003; Chambers et al. 2002; Hodgins et al. 2004; Hofmann & Ray 2001; Klein 2002; Lang & Heasman 2005; Statistics Canada 2005a).

As with other nations, Canada has realized the effects of urbanization. Over eighty percent of the population now resides in urban centres (Burgess et al., 2006). Rural depopulation has resulted in concentrations around three major urban corridors where over fifty percent of Canadians reside: 1) Quebec City, Quebec to Windsor Ontario, 2) the lower mainland of British Columbia and Vancouver Island, and 3) The Edmonton/Calgary corridor in Alberta.

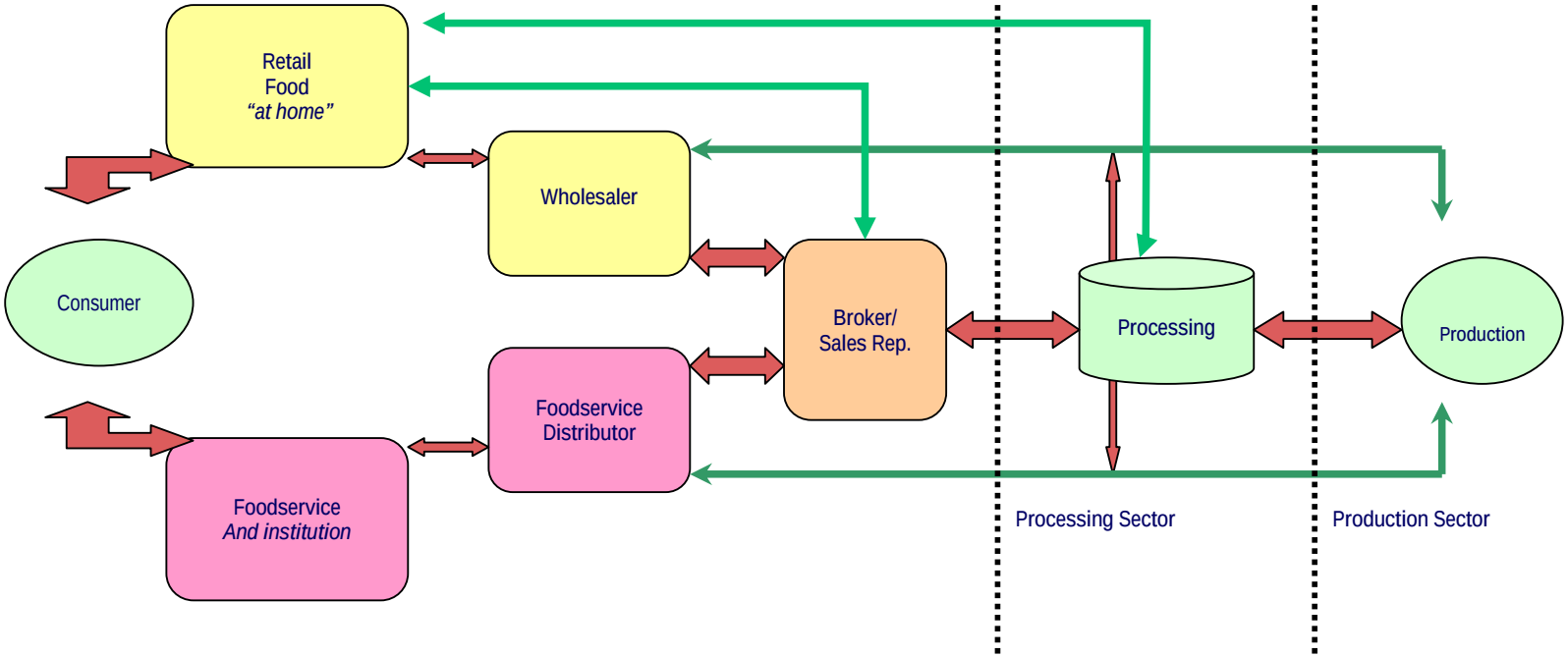
As pressure increases on the urban sprawl, land traditionally used for agriculture is being lost to urbanization and developmental purposes other than food production (Friedmann 2004; Hofmann & Ray 2001). British Columbia as an example established the Provincial Agricultural Land Commission in 1973 as the province realized that its agricultural land was in jeopardy to urban sprawl. The independent agency governs access to the Agricultural Land Reserve. When established it covered close to five million hectares. Generally, it has been able to protect that land. But pressures grew. The City of Abbottsford, surrounded by prime agricultural land, applied to the Commission to utilize three hundred and seventy-two hectares of land for job creation and economic growth. In July 2005, the Commission agreed that the City could utilize about half of the hectares of the land requested for those purposes (The Provincial Agricultural Land Commission 2006). Friedmann argues that protecting our rich agricultural land is vital to protecting local food supplies (Friedmann 2004).

Canada's gross domestic product is valued at $1.428 trillion (Brown et al. 2010). The food system continues to play a major role in Canada's economy accounting for just over eight percent of Canada's GDP and providing one in every eight jobs in the country's economy (AAFC 2009).

The Canadian food system however did not begin with the primary goal of economic development. It had its roots in the need to build a nation (Winson 1993) thus drawing immigrants. It has evolved to one that is demand driven (AAFC 2004; Evans

& Lozinski 2004) and is part of the emerging third food regime that is marked by the strength of the global retailers (Burch & Lawrence 2005). Figure 13 on the following page developed by Agriculture and Agri-Food Canada (AAFC) illustrates a supply chain that responds to both a demand and supply-driven chain taking into consideration the traditional steps in the movement of agricultural products through the system.

Figure 13: Canada's agri-food system 2004



Source: (AAFC 2004)

AAFC's depiction of the national food system reflects changes similar to that of the global food system. The similarity however is limited to the acknowledgement that the movement of raw materials through to products has changed. It illustrates that raw materials are no longer simply pushed through the system but rather are also subject to being pulled through the system to meet the demands of the buyers. The depiction however still portrays a chain and does not acknowledge the collection of networks that represent the Canadian demand network as illustrated in Figure 14 on the following page.

In Canada, the supply chain transition to the demand network has also happened in order to fend off the aggressive entrance by Wal-Mart into the Canadian marketplace (Morrissy 2006). The impact has been consolidation in order to achieve control, economies and efficiencies. SunOpta Inc., a publicly traded company based in Brampton, Ontario for example has developed strategic alliances with, or acquired, over sixteen companies throughout the Americas in order to increase its power base. Consolidation has also meant however that strong companies are acquired by non Canadian companies. Molson Brewing, a Canadian powerhouse, established in Montreal, Quebec in 1786 merged with Adolf Coors Company of the United States in 2005 essentially delivering the power in the company to the American company. Sisu Enterprises of Vancouver, British Columbia is another example. It was recently purchased by NBTY of New York. And Flora Manufacturing & Distributing Inc., while still operating manufacturing facilities in Ontario and British Columbia as well as the United States, has moved all decision making south of the Canadian border (Hodgins & Fitzpatrick 2007).

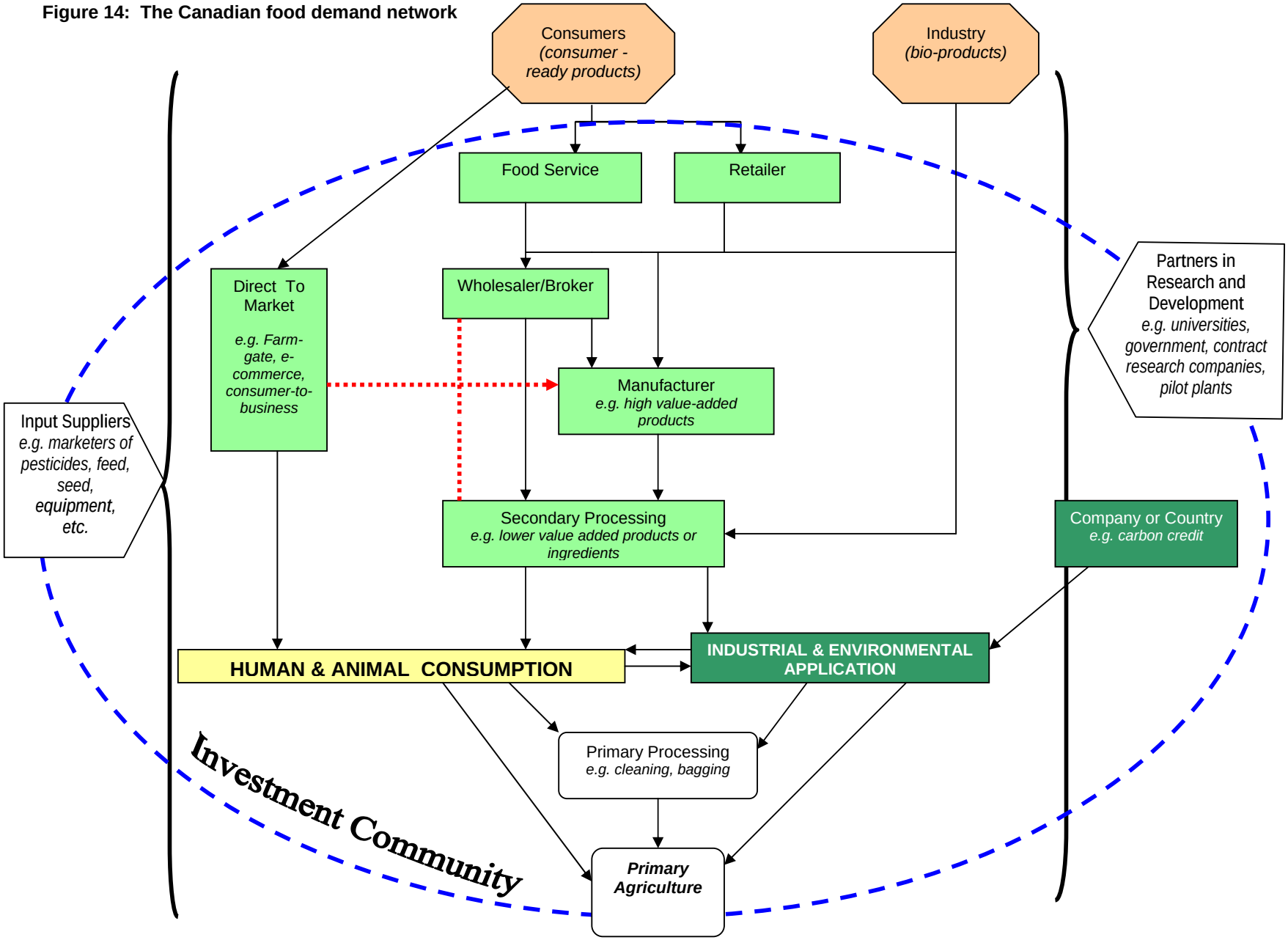
In addition, the inversion of the supply chain to a demand network has also meant that the distribution of benefits has changed. Increasingly, the larger share of the margins realized from food products is going to the retailer (Coleman et al. 2004).

An example of such a network involves Bioriginal Food and Science Corporation of Saskatoon, Saskatchewan. The company is a result of 1993 merger of two companies. The company produces and markets a line of essential fatty acid solutions in the form of natural health products, cosmetics, functional ingredients, food and feed. To achieve this end, it has formed partnerships, contractual agreements and alliances within the network including farmers, packagers and research institutes across North America such as the National Research Council of Canada, Harvard Medical Centre and Tufts University. It has made extensive use of

government programs and has offices and manufacturing facilities in Canada, the United States, Europe and China. It also offers its custom formulation expertise as a service to other companies. Investors are from across the spectrum from a consortium of producers to venture capital funds. While the company was founded on plant based sources of essential fatty acids, it has recently gone into partnership with a major producer of fish based omega-3 fatty acids to meet consumer demands (Bioriginal Food and Science Corp. 2004). The network within which Bioriginal operates is yet one example of the emergence of the demand network.

Figure 14 therefore is more reflective of the network within which the Canadian agri-food system currently operates and is more in line with Lang's depiction of the food system as illustrated in Figure 1 (Lang 2010b).

Figure 14: The Canadian food demand network



It is evident from the depiction of the demand network that it is growing increasingly complicated. In the past, the focus was on the production community with farmers focused solely on producing goods with little effort required for marketing.

Producers in Canada are now actively participating in the demand network. Specific examples are value chains where members of the demand network collaborate to share the risk and rewards to bring new products to the market. Five value chain initiatives were undertaken in the province in Saskatchewan. An example was driven by Prairie Berries, a Moose Jaw, Saskatchewan company. The value chain encompassed seven Saskatoon berry growers, Prairie Berries, Federated Co-Operative and Snowcrest, a packing house that is a division of Ontario based Omstead Foods. The result was the availability of frozen Saskatoon berries throughout Western Canada at Co-Ops (the retail arm of Federated Co-Operative) and select eastern Canadian outlets. Other value chains included a bison co-operative and Safeway formed to offer bison burgers at the Grey Cup, the Canadian Football League championship game. Another value chain included the lamb producers and Costco Wholesalers to offer lamb kabobs at Costco stores throughout western Canada in order to make the lamb industry less reliant on U.S. markets (Saskatchewan Council for Community Development 2003).

2.1.1 Retailers

Food retailers in Canada continue to enjoy the lion's share of the consumer food dollars. In 2008, Canadians spent $78.7 billion at food stores. This amount represented a 3.9 percent increase over the previous year (Thoren 2009) higher than the 1 percent annual growth rate in the population (Grier 2005).

The five largest food retailers account for approximately 60 percent of grocery sales in Canada (Longtin et al. 2006), four of which are Canadian owned: Loblaw Companies Ltd., Sobeys Inc., Metro Inc. and Overwaitea Food Group. There are over 24,000 food retail outlets in Canada employing approximately 588,000 people. Of greatest significance however is that the major retailers are consolidating not only horizontally but also vertically by acquiring and operating their own distribution systems (Longtin et al. 2006)

Private labelling is growing in Canada and comprises 23.8 percent of all sales at the major grocery chain (Strauss 2007). Retailers/distributors are continually searching for opportunities for private labels in order to increase their profits (Elfers 2005; Lawrence and Burch 2008).

With the downturn in the global economy, discount food retailers realized a six percent growth rate in 2009 over 2008 (Burn 2010). While Costco is considered the leader in the alternative grocery channel, Wal-Mart is posing the highest threat to the traditional Canadian grocery market due to its high growth rate (Grier 2005). Wal-Mart is considered a rising competitor in the Canadian food industry in order to compete with Loblaws. Wal-Mart is expected to open 180 supercentres (major food component in addition to dry goods) in Canada by 2013. (Robinson 2006)

Smaller, specialized chains and stores that target specific market niches are showing strength in the Canadian food retail sector. Of particular interest is the entry into Canada of the highly successful Whole Foods Market chain based in Texas, U.S. The company claims to be the world's largest organic and natural food chain. It currently has three Canadian outlets in Toronto and Oakville, Ontario and West Vancouver, British Columbia and another under development in Vancouver, British Columbia.

2.1.2 Foodservice

The foodservice industry in Canada is currently valued at $60.1 billion for all foodservices exclusive of institutional services and employs 1,084,500 people (CRFA 2010).

Interestingly, the large chains do not hold the power in this sector as with retail. While there are many regional chains such as the Lone Star Texas Grill and its affiliated Big Daddy's Crabshacks in Ontario and the Swiss Chalet throughout Canada, independent restaurants captured the majority of sales in the sector.

Canadians spend twenty-three percent of their total food dollar on foodservices in 2008 (CRFA 2010; Statistics Canada 2010b). Many reasons are credited for the drop in the percentage of food dollars from a high of forty-one percent in 2002. The growth of convenience foods at the retail sector has taken a chunk from the foodservice sector. As well, the sector is highly dependent on tourism. The impact of SARS in Canada in 2003 on tourism and thus the foodservice sector was significant. The current rising value of the Canadian dollar against the American dollar has already hit the tourism industry and thereby resulted in a negative impact on foodservices. In addition, the recent economic crisis has forced many consumers to spend their food dollars at the retailers rather than foodservice sector (AAFC 2009).

2.1.3 Processors and Manufacturers

Food manufacturing makes a significant economic contribution to Canada. The value of all food and beverage processing in 2009 was $90 billion (Burn 2010). This sector ranks second only to transportation and equipment manufacturing in its contribution to total manufacturing to Canada's GDP at 12 percent but accounts for 15 percent of all manufacturing jobs (Longtin et al. 2006) .

To put this into perspective, the top food processor in Canada and the U.S. in 2008 was Nestle (U.S. and Canada combined) with sales of USD$26.5 billion. The top four processors – Nestle (U.S. and Canada), Tyson Foods Inc., PepsiCo Inc. and Kraft Foods Inc. – had combined sales of USD$102 significantly larger than Canada's entire food manufacturing industry (Fusara 2009).

In a recent analysis of the top food and beverage processing companies in Canada and the U.S., nine Canadian-owned companies ranked in the 'top 100' in 2008 as defined by sales: Saputo Inc. ranked nineteen, Maple Leaf Foods Inc. ranked twenty-third, Agropur co-operative ranked thirty-fifth, McCain Foods ranked fiftieth, George Weston Ltd. ranked fifty-second, Canada Bread ranked fifty-fifth, Cott Corporation ranked seventy-second (Fusara 2009). Note that there is dispute in the reporting of the rankings based on sales. For example, McCain Foods Limited is ranked first in the Canadian rankings with sales identified as CDN$5 billion (Burn 2010). The North American rankings list McCain sales at USD$1.8 billion for that same year (Fusara 2009). Other discrepancies were noted in sales figures with other companies as well.

The majority of the country's top food manufacturers are found within the highly populated area along the Windsor-Quebec City corridor. Specifically, the Greater Toronto Area is home to North America's second largest food manufacturing cluster. One of its major competitive advantages is its location. The area has access to over one hundred and twenty million consumers within a twenty-four hour driving distance (BEDO 2005).

There is a push in Canada to expand the processing and manufacturing sectors related to agriculture. Food processing and manufacturing has become increasingly important to the Canadian agri-food industry. Canada ranked fifth globally in both import (CDN$20.43 billion in 2004) and export (CDN$26.45 billion in 2004) of agriculture and agri-food products. Consumer oriented products showed the most growth, doubling over the previous ten years and accounting for over half of all

exports of the agriculture and agri-food exports (AAFC2005). During the economic crisis of 2008 and 2009, however the value of exports of Canadian food products shrank by 6.2 percent. Estimates for 2010 predict some recovery with exports increasing by 5 percent (Burn 2010).

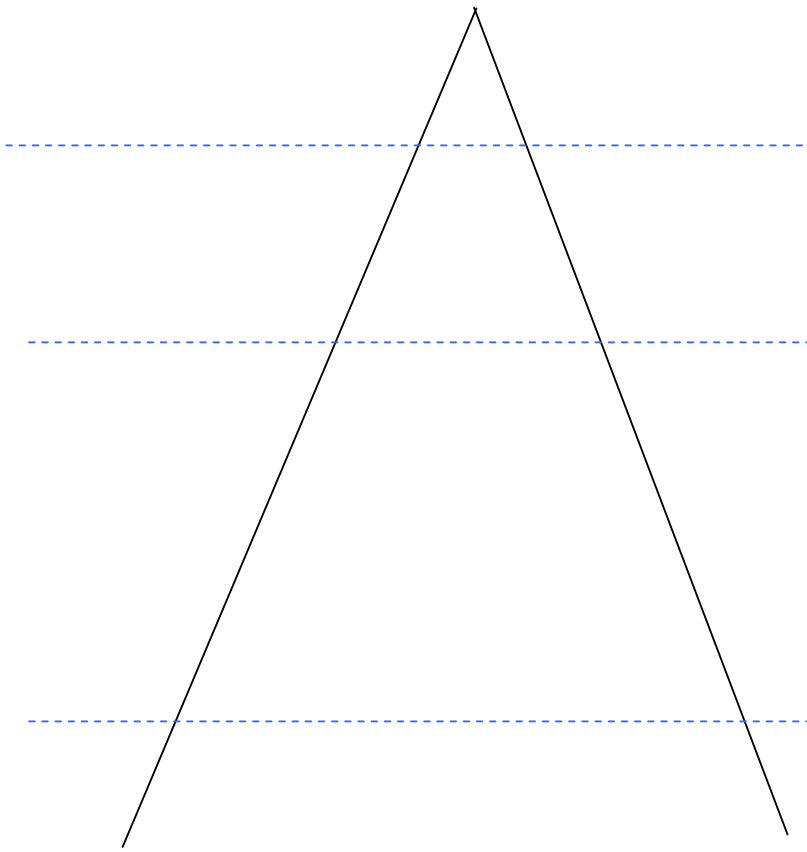
Overall, eighty-five percent of Canadian exports were shipped to the U.S. in 2004 (Papadotos 2005). That percentage has been reduced to seventy-three percent in 2009 as Canada seeks more diversification in its markets (Statistics Canada 2010b). Only 51 percent of Canada's agricultural and agri-food exports however are headed for its southern neighbour. Japan represents the second largest market for Canada's exports in this industry at 9 percent (AAFC 2010).

There is still a concern however that the Canadian agri-food system focuses too much on commodities. The growth of commodities has resulted from a technology push on production and has resulted in surpluses and price declines (Rance 2005). Canada's infrastructure and focus has been on production and it does that well. Canada is increasingly finding it difficult however to compete against countries that overproduce in certain areas (Lussier 2005). Competing against its heavily subsidized U.S. and European counterparts is difficult. Focus on more value added activity is required.

New opportunities are being identified for this sector through the primary drivers currently in the agri-food system of health and the environment (Lang and Heasman 2005). The shift to a new emphasis that captures higher value from agricultural based products has emerged (AAFC 2006).

Flax is a primary example of the move to high value added derived from what has been considered in the past a basic commodity. Figure 15 demonstrates that the crop is not only sold in bulk but has much higher value added applications. An example of a higher value product is the extraction of lignans from the flax seed and used as a dietary supplement to promote breast health (Hodgins & Patterson 2004).

Figure 15: The flax application pyramid



Very High Value Added Flax – Fractions and fraction applications (fibre, oil applications, lignans, protein): Few players to date (Bioriginal's FibrOmega and BakOmega, ADM Nutraceutical's Flax lignan complex, Lignan Research LLC's Brevail, Forbes Medi-Tech's Vivola Oil, Natunola's Omega-3 Flax Fibre, Acatris's LinumLife)

Higher Value Added Flax: Pressed flax oil offered by a multitude of packagers to be sold as salad oil or as a nutritional supplement (major oil pressers – Barlean's, Omega Nutrition, Flora Manufacturing & Distributing Ltd., Bioriginal Food & Science Corp.) - some oils have added lignans (e.g. Omega Nutrition's Hi-Lignan Flax Seed Oil, Barlean's Organic Lignan Flaxseed Oil)

Medium Value Added Flax: Flax seed incorporated into an increasing number of food and feed applications available on the market (e.g. Nature's Path organic Flax Plus Granola, Clif's Luna Bar, Flax-O-Meal's Low Carb Pancake and Waffle Mix, Natural Pet's Missing Link pet supplement, Rogers porridge oats with flax seed)

Second Generation products of flax in feed to produce (Halliday, 2007) omega enriched products (e.g. omega enriched eggs, omega enriched poultry, etc.)

Flax stalks incorporated into biocomposite materials to be used in green building materials

Low Value Added Flax: Bags of flax seed often sold with or without branded labels at health food stores in the refrigeration unit or using vacuum packaging – many Canadian players (e.g. CanMar Grain, Pizzey's Milling, Randolf & James)

Source: (Hodgins & Patterson 2004)

Herath et al. conducted an analysis of the health food segment in Canada. The results of their analysis indicate that the fear of disease, particularly in the aging population is a critical driver of consumer uptake of food and supplements/natural health products related to health outcomes (Herath et al. 2008)

The shift to health and wellness products is not unique to Canada. The multinational companies have all entered the market to produce products aimed at the consumer demand for products that provide a health benefit (Millstone & Lang 2003) Lawrence and Burch argue that the shift on the part of food manufacturers to wellness products is driven by these players "*seeking both to cash in on the supposed revolution in the attainment of personal health benefits among consumers in the North, and to promote their credentials as food authorities"* (Lawrence & Burch 2008) p.10. These researchers however suggest that further research is required to fully understand the impact of the changes that are occurring in the food system as a result of the shift to wellness.

2.1.4 Production

In total, the land base for agriculture covers approximately seven and a half percent of Canada's vast country. Eighty-one percent of Canada's agricultural land is found in the prairie provinces of Alberta, Saskatchewan and Manitoba (Chambers et al. 2002; Longtin et al. 2006) with Saskatchewan alone holding nearly forty percent.

Table 3 below demonstrates that the amount of farm land lost over a ten year period has been marginally reduced. Canada's 2006 census identified however just over a seven percent decrease in the total number of farms in Canada over a ten year period (Proudfoot 2007). The table demonstrates the changes in the farming community over the past ten years based on census data: fewer farms, fewer farmers and aging farmers.

Table 3: The changing face of Canadian farms

	1996	2001	2006
Total number of farms	276,548	246,923	229,373
Total number of farmers	385,610	346,195	327,055
Average age of farmers	47	50	52
Total number of farm families	216,420	187,770	Not available
Total area of farms (in millions of hectares)	68.1	67.5	67.6

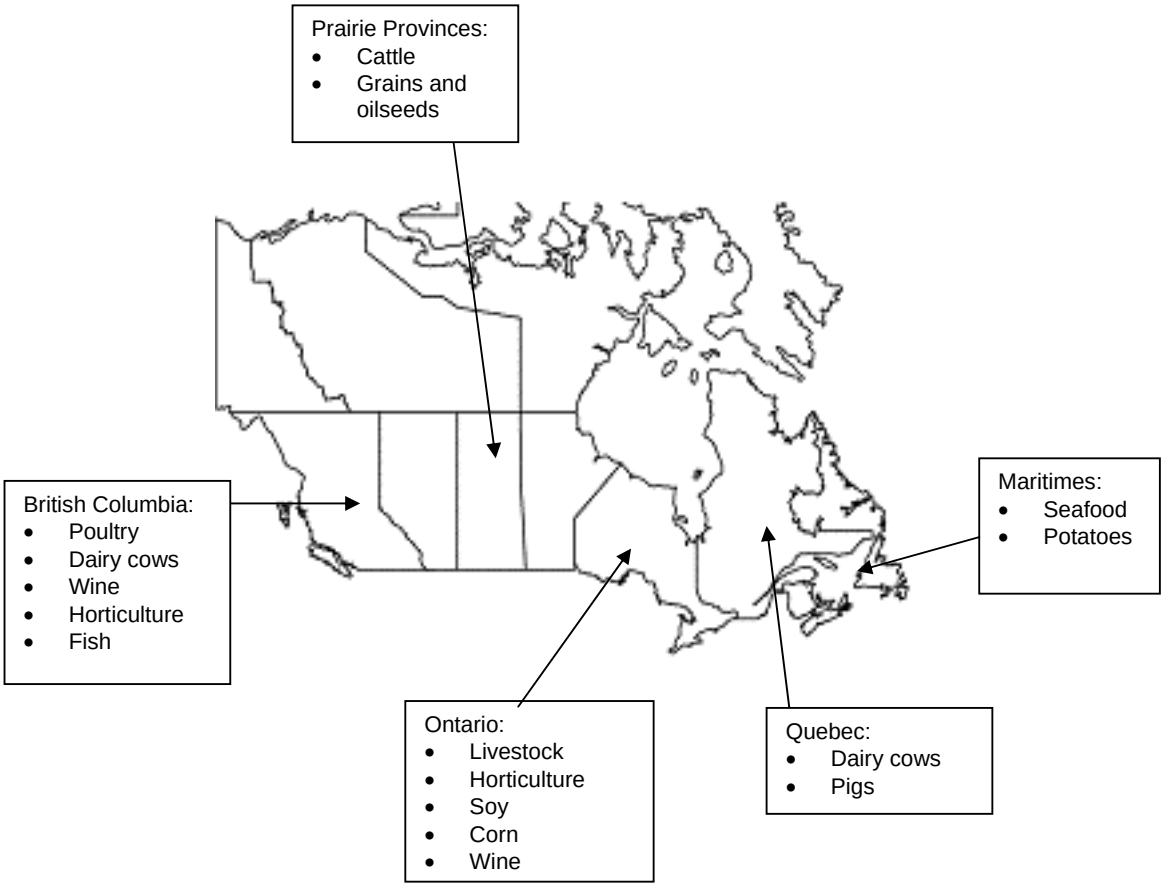
Source: Statistics Canada based on the 2006 national census figures

Producers who are choosing to stay farming are increasing their farm sizes to realize economies of scale. Farming is no longer about a way of life but rather a business. With the transition of agriculture to big business, it is increasingly difficult to attract new people to farming due to the high cost of machinery and other costs of production to meet the demands of the processing community (Winson 1993).

By value, AAFC reports that the top three commodities of agricultural production in Canada in 2005 were: red meat valued at $6.8 billion; grains and oilseeds valued at $6.9 billion; and, dairy valued at $4.8 billion (Longtin et al. 2006).

Due to Canada's vast geography, the country's regions offer a diversity of raw materials for the food and bioproducts systems. The diverse nature has resulted in commodity specialization (Skogstad 1987). The following map illustrates the regions of Canada and the top commodities produced in each area.

Figure 16: Canadian agricultural foci by region



As illustrated in the map, Canada is a vast country. Most the major agricultural producing provinces are far from markets and food manufacturers. Transportation and the cost of transportation is an issue for primary producers. Producers no longer enjoy special rail rates to transport grain that was negotiated with Canadian Pacific Railway (CPR) in 1897 and lasted almost a century. The deal negotiated by the Government of Canada gave the CPR access to British Columbia through the Crow's Nest Pass and the farming community cheap rates (commonly referred to in Canada as the Crow Rate) to ship grains and flour east (Winson 1993). This special rate lasted almost a century.

The meat and poultry industry is strong in Canada and represents the country's largest food manufacturing sector at $24.3 billion in shipments in 2009 (Burn 2010). The primary agriculture sector however has been negatively affected in recent years by three major events: bovine spongiform encephalopathy (BSE), avian influenza (AI) and potato wart.

BSE was found in one head of cattle in Alberta in May 2003 thereby shutting the border to the U.S. to Canadian live cattle and beef for approximately two years (boxed beef and live cattle under the age of thirty months accepted to cross the border in July 2005). This resulted in lost revenues in exports of $1.8 billion (Standing committee of Parliament) and a total overall cost to the industry of $9 billion (foodnavigator.com 2007).

The AI outbreak in British Columbia in the spring of 2004 resulted in a depopulation of 14.9 million birds costing the industry over $380.5 million. The provincial government paid out $63.7M to the industry to assist in recuperation (Hudson & Elwell 2004; Paulson 2005).

Potato wart found in Prince Edward Island (PEI) locked the entire province's 2000 potato crop out of the U.S. market, its principle export market. PEI represents approximately 30 percent of Canada's potato exports to the U.S. and approximately 1-1.5 percent of the province's GDP. The financial loss to the producers was estimated at $30 million to February 2001 (APEC 2001). No further economic impact analysis has been conducted on the impact on the other aspects of the logistics channel (e.g. processors, transportation, etc.) or longer term impacts on markets.

It is important to note these crises. From a public policy perspective, crises result in reallocation of resources and therefore impact policies and policy intentions. This aspect will be explored further in the chapter.

The expansive country of Canada not only has resulted in regional differences on the major foci for production, but also for varying marketing approaches which have often caused friction within the producer segment of the nation (Skogstad 1987). In addition to the free market system, other methods include legislated single desk selling, orderly marketing systems and cooperative marketing systems.

The legislated single desk selling approach requires that product grown as identified under federal or provincial legislation be sold through a specific marketing organization. The most notable of these 'desks' is the Canadian Wheat Board (CWB). Founded in 1919 and protected by federal legislation, the CWB has secured approximately 20 percent of the global market for wheat. All wheat, durum wheat and barley grown in the Prairie Provinces and the Peace River district of British Columbia must be sold through the CWB. It markets the product for about 85,000 Canadian producers within its legislated territory. The CWB is administered by the Canadian Grain Commission in Winnipeg, Manitoba (Canadian Wheat Board 2005). The issue of the continuation of the CWB as a mandatory organization is contentious and divisive among its members (Larsen 2007) as well as the current members of Parliament.

The orderly marketing system is often termed supply management. The goal of such a system is to ensure that sufficient quantities of the products are available for the Canadian consumers and that over production does not occur. The dairy, poultry and egg industries are examples of orderly marketing systems in Canada and are governed under federal or provincial/territorial government legislation depending on the commodity (O'Reilly 2008).

In addition to mandatory systems, Canada is noted for cooperative marketing activity where producers willingly come together to undertake specific activities. The activity may be in the form of yearly price setting by province such as in the seed potato industry and granted under various provincial legislations. Another application is for more active participation in the preparation and movement of product to the market.

The cooperative movement was founded in Western Canada (Winson 1993). Not surprising therefore, the most renowned cooperatives found their roots in the development of grain handling, notably the Alberta, Saskatchewan and Manitoba Wheat Pools. Approximately three hundred cooperatives in Canada are registered legal entities marketing agricultural product valued at approximately CDN$8.9 billion (Longtin et al. 2006).

While the number of farms and producers have decreased dramatically over the years, the vast number that still exist does not equate to sufficient strength required to offset the power imbalance that exists as a result of consolidation at other levels of the demand network (Winson 1993). This increasing imbalance along with the need to identify and promote their own opportunities has given rise to commodity specific groups. Examples in Canada include: the British Columbia Salmon Marketing Council, the Canadian Cattlemen's Association, the Canola Council of Canada, Pulse Canada, Ontario Soybean Growers, Canadian Dairy Network and the Wild Blueberry Association of North America (WABANA). WABANA is an interesting organization in that its membership is comprised of wild blueberry producers and processors from Quebec, Atlantic Canada and the state of Maine in the U.S.

These organizations are most often funded by variations of levies, based either on a flat membership fee, on production volumes or sales. These associations have paid staff to administer the needs of the commodity. Some associations have become powerful in that levies can be used for lobbying activities as was seen in the 2003-2005 BSE crisis in Canada and the significant lobbying of the Canadian Cattlemen's Association to garner the Canadian government's assistance in seeking the reopening of the U.S. border to its cattle and products.

Commodity groups are now aligning themselves with groups in the U.S. On a formal basis, the Wild Blueberry Association of North America officially represents a good example of promotional activities that benefit the commodity group as a whole such as market entry into Europe or as an ingredient into the breakfast cereal sector.

Other organizations such as the Saskatchewan Flax Growers work on specific projects with Ameriflax in the U.S. to advance the interests of the flax industry as a whole.

In other words, agriculture is no longer about a way of life. It is about corporate farming (Winson 1993). It is about the business of farming. It is about producing specific commodities, varieties and volumes for specific processors. A good example of the transition is in the potato processing industry where potato producers particularly in the Maritimes, Manitoba and Alberta enter into contracts with the large French-fry processors such as: McCain Foods with potato processing facilities in Florenceville, Quebec and Portage La Prairie, Manitoba; J.R. Simplot with a Canadian potato processing facility in Portage La Prairie, Manitoba; Cavendish Farms with potato processing facilities in New Annan, Prince Edward Island, and Jamestown, North Dakota (U.S.); and, Maple Leaf Foods with a potato processing facility Lethbridge, Alberta (Drouin 2008).

Interestingly, it appears that the emergence of large, corporate farms has been a factor in the consolidation of manufacturing and its power base (Winson 1993). With roots back to 1891, production contracts play an important role in the tomato processing sector situated in South Western Ontario. Mergers over the years have resulted in an 85 percent control of the industry by H.J. Heinz Co., Nabisco (both American owned) and Sun-Brite (Canadian owned) (Pritchard & Burch 2003).

The transition has also resulted in an upsurge of entrepreneurial vertical and horizontal integration on the part of producers who wish to maintain control over their own operations.

Nancy Smithers of Naturally Nova Scotia in Dartmouth, Nova Scotia represents an entrepreneur who wished to maximize her returns on the farm and participate in the full demand network. Her operation was established in 1994 based on developing and marketing herbal remedies locally. Her farm now is used only for research and development purposes. She contracts producers across Canada for raw supply of organic herbs. Her vast product line can be purchased directly from her web site. She also produces goods for Loblaws for its private label President's Choice. In addition, she has successfully penetrated the Japanese market by employing marketers to work directly with ITOCHU one of Japan's largest food distributors to market her products as well as identify new product concepts for the Japanese market. In addition, she opened a store-front operation in Hong Kong (Hodgins et al. 2004).

2.2 The evolving food system

Just as the supply chain has transitioned into a demand network, the food system appears to be transitioning into a component of the bioeconomy.

The Organization for Economic Cooperation and Development (OECD) defines the bioeconomy as *"the aggregate set of economic operations in a society that use the latent value incumbent in biological products and processes to capture new growth and welfare benefits for citizens and nations"* (OECD 2006) p.3. Both Hilgartner and Gault use this definition for their purposes (Gault 2007; Hilgartner, 2007).

Gault adds that examples of applicable sectors within the bioeconomy are healthcare, food, agriculture, biofuels and security (Gault 2007). The concept encompasses the use of technologies such as biotechnology, nanotechnology and genomics.

With respect to the food sector, Gault specifically identifies functional foods and nutraceuticals as being under the umbrella of the bioeconomy (Gault 2007) although it is unclear whether the food system in general has or ever will be completely enveloped under this rubric.

Following Gault's lead however, one example of the new bioeconomy is the functional food and natural health products' segment. Terminology varies around the globe.

Health Canada through its Natural Health Product Directorate (NHPD) utilizes the term natural health product rather than nutraceutical or dietary supplement. Under the legislation, a natural health product is a *"substance set out in Schedule 1 or a combination of substances in which all the medicinal ingredients are substances set out in Schedule 1, a homeopathic medicine or a traditional medicine, that is manufactured, sold or represented for use in a) the diagnosis, treatment, mitigation or prevention of a disease, disorder or abnormal physical state or its symptoms, in humans; b) restoring or correcting organic functions in humans; or c) modifying organic functions in humans, such as modifying those functions in a manner that maintains or promotes health"* (NHPD 2003) p.33. Examples include beta-glucan from oats, essential fatty acids from marine or vegetable oil or ginseng.

Functional foods also come under the purview of Health Canada. A functional food is *"similar in appearance to, or may be, a conventional food, is consumed as part of a usual diet, and is demonstrated to have physiological benefits and/or reduce the risk of chronic disease beyond basic nutritional functions"* (Canada 1998) p.3.

A 2007 survey conducted by Statistics Canada identified six hundred and eighty-nine companies operating in the Canadian FFNHP segment representing a seventy-seven percent increase over 2005 findings (Cinnamon 2009). The increase could appear to be questionable, but an explanation for the remarkable change may be a redefinition of the sector by industry itself. While new companies are expected in an emerging sector, current players could be repositioning or redefining their companies or products. For example, an artisan bakery could have classified itself under the traditional food sector in 2005 but as a functional food company (or in the production of functional food products) in 2007 if utilizing whole grains. Another example may be a dairy that in 2005 produced yogurt but by 2007 added a probiotic yogurt to their line.

Companies are required by law to respond to surveys conducted by Statistics Canada however there is a strong likelihood that the sector is larger than estimated. It also is likely that the number of companies operating in this sector is higher than reported.

A recent study of the Western Canadian segment identified three hundred and eighty-one companies operating in the western region (Hodgins 2010b) representing fifty-six percent of the country's FFNHP segment when compared to Statistics Canada figures. Southern Ontario and to a lesser extent Quebec represent the strength of the food manufacturing sector in Canada and therefore it is a reasonable assumption that a number of these companies are incorporating functional ingredients into their manufacturing process in order to increase their margins. They may not be accounted for in the Statistics Canada survey.

The 2007 survey also identified that total revenue for the FFNHP manufacturing sector was $3.7 billion representing a twenty-eight percent increase in revenues over the previous survey in 2005 (Cinnamon 2009; Palinic, 2007). Traditional food manufacturers are expected to continue to enter this segment given the increasing awareness of consumers of the need for better nutrition and the fact that margins are higher in this segment than for traditional food products. The entrance of the

established players along with the movement of the population to a prevention based health model would help the FFNHP segment to reach its potential. One study argues that the potential Canadian market for these products is US$50 billion (Basu et al. 2007).

Of interest is the employment status of the segment. In 2007, the segment employed almost fourteen thousand, many of which were classified as HQP. Fifty-five firms identified that they are have difficulty filling scientific research and development positions. The most predominant reasons given were that they are having difficulty finding candidates with either the expertise or qualifications required (Cinnamon 2009). Basu et al. also found the lack of highly qualified personnel to be a hindrance to growth of this segment (Basu et al. 2007). This is a significant point given that Canada is attempting to position itself as a knowledge-based economy (MacKinnon 2005).

The 2007 survey revealed that Canadian FFNHP segment spent $148 million on research and development activities in 2006 (Cinnamon 2009). This point is somewhat surprising. While the segment grew in both number of companies and sales revenues, the amount invested in research and development actually declined from the previous survey results by almost $15 million (Palinic 2007). Note that these figures did not include the investment in research and development by other actors such as Canadian federal and provincial government research institutes, not-for-profit agencies or universities.

Public funds are being invested to support the growth of the FFNHP sector. The National Research Centre (NRC) aims to foster cluster development through the establishment of three clusters in Canada that serve the FFNHP segment: Plants for Health and Wellness Cluster in Saskatchewan; Institute for Marine Biosciences in Nova Scotia; and Institute for Nutrisciences and Health in Prince Edward Island. While these are NRC initiatives, they have partnered with other actors to deliver the services. For example, the Institute for Nutrisciences and Health has as its partners the Atlantic Canada Opportunities Agency, Agriculture and Agri-Food Canada, the Government of Prince Edward Island and the University of Prince Edward Island. These clusters work with all actors in the triple helix of innovation with the goal of economic development in the region (NRC 2010).

AFMNet (the Advanced Food and Materials Network) is another example of an initiative of the Government of Canada through its Networks of Centres of Excellence Program. It is centred in Ontario at the University of Guelph but focuses on research collaboration through a network of academic and government researchers. One of the goals is the development of healthier foods, including functional foods and bio-materials (AFMNet 2010). Its funding however was not renewed and the network will wind down operations in April 2011.

As well, the Canadian government provided funding of $721,000 for Nutri-Net Canada, a coalition of functional food and natural health products' companies and non government organizations. The goal is to develop a national industry-led strategy for the segment (Nutri-Net 2010).

Canada's FFNHP segment offers a wide array of well established entrepreneurial companies across the country. Many of these companies are global leaders such as Bioriginal Food & Science Corporation in omega-3 fatty acids, Ocean Nutrition Canada (ONC) in fish oils and Institute Rosell-Lallemand in probiotics (Hodgins et al. 2004).

The traditional food system has embarked on a new era. It is founded upon new concepts, science, technology and innovation. Herath et al., academics at the University of Guelph in Ontario, argue that *"relatively little is known about the factors which enhance a firm's ability to undertake advanced food innovation broadly, and FFN* [n=natural health products] *product development and commercialization specifically"* (Herath et al. 2008). What is required however is a good understanding of innovation and its intended and unintended consequences.

2.3 Innovation

> *"Canada faces tough questions about its role in the changing global economy. In this new economy, competitiveness and productivity are determined by how effectively and how rapidly nations can translate emerging knowledge into new and innovative products, policies and services". (CIHR 2006) p.3.*

The above quote in a Canadian Institutes for Health Research (CIHR) publication illustrates the challenge faced by nations if they wish to compete. The CIHR is not alone. Herath et al. argue that innovation is a critical component to a successful economy and Canada must gain a better understanding of how to benefit from it (Herath et al. 2008).

The following section provides an overview of innovation as it is perceived in Canada.

2.4.1 How is innovation defined in Canada?

Two common themes are present in the definition of innovation in Canada: outcome focused primarily on economic returns; and a system or network of knowledge.

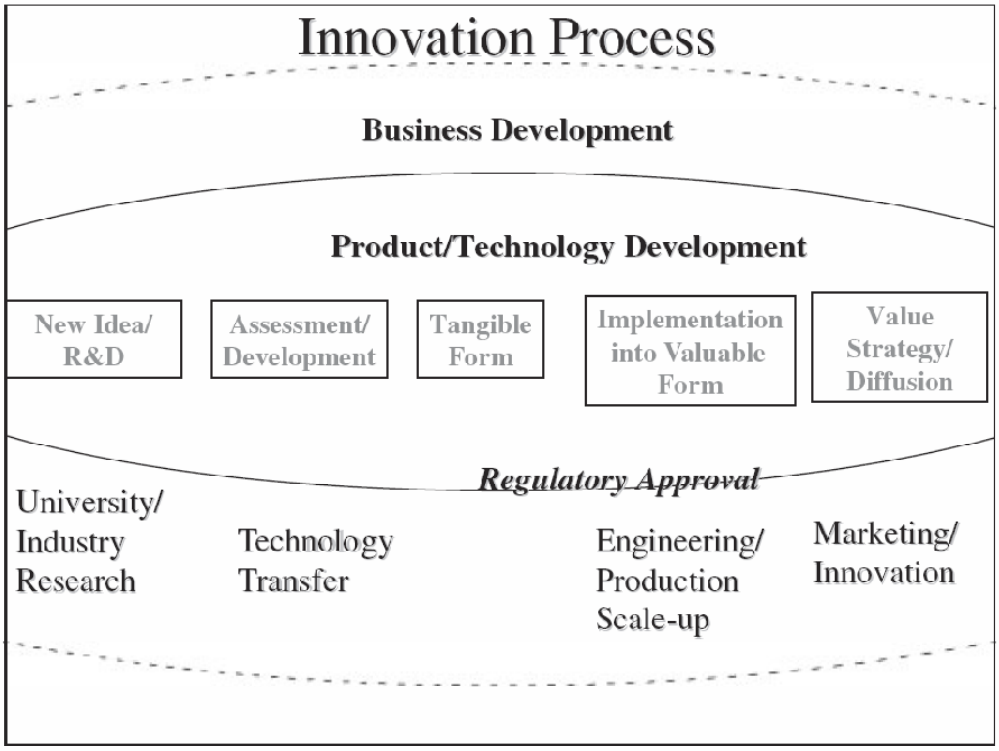
The first definition is the predominant theme in Canada. As noted in the previous chapter, the Conference Board of Canada defines innovation as *"a process through which economic or social value is extracted from knowledge - through the creation, diffusion and transformation of ideas – to produce new or significantly improved products or processes"* (Munn-Venn 2006) p.2. The focus therefore is not on a system that creates new knowledge but rather on the downstream activity of translating or commercializing ideas for benefit.

Kevin Lynch, Vice-Chair of the Bank of Montreal Financial Group, argues that innovation drives productivity, growth and a country's living standards. He argues that creativity is the foundation of a country's competitiveness and that *"innovation is the ability to create new products and services, to produce existing products in new ways, and to develop new markets"* (Lynch 2010). Again the focus of innovation is on commercialization.

Gray and Weseen, academic researchers, utilize the definition of OECD. In their paper developed for Agriculture and Agri-Food Canada (AAFC) they use the definition: *"An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations"* (Gray & Weseen 2008; OECD 2005) p.46. This definition also focuses on economic outcomes.

Herath et al. also focus on economic outcomes in writing of innovation. They do not however provide a definition of it but rather depict it as being a linear commercialization pathway approach that results in value as demonstrated in their figure below.

Figure 17: Process for developing and commercializing innovations



Source: Herath et al. 2008

AAFC linked innovation with economics prior to Gray and Weseen's submission. Departmental literature notes that it – innovation – is a key component of economic prosperity (AAFC 2006). All too often it appears that innovation in the humanities (e.g. justice systems, welfare systems, cultural systems, etc.) does not receive the priority focus that is garnered by innovation focused on economic activity (Coates 2005).

Examination of various federal and provincial government ministry strategies indicates that innovation is defined in terms of what it hopes to achieve rather than having an understanding of the concept itself. Ontario for example, Canada's largest province, has established the Ministry of Research and Innovation and speaks of innovation in terms of global competitiveness and economic terms that also results in social gain (Ontario Ministry of Research and Innovation 2006). But clearly the emphasis is on providing economic benefit. The province has established Ontario Centres of Excellence whose goal is to work with industry to commercialize innovative applied science and technology. Five Centres have been established, each focusing on specific areas: energy; communications and information

technology; earth and environmental technologies; materials and manufacturing; and photonics (Ontario Ministry of Research and Innovation 2006).

Newfoundland and Labrador's Ministry of Innovation, Trade and Rural Development has included an innovation definition in the province's innovation strategy*: "the creation, sharing and implementation of new ideas resulting in economic value and/or social gain"* (Ministry of Innovation 2006) p.10.

Most provincial agriculture departments have developed innovation strategies linking to the federal government's agricultural Growing Forward policy framework (to be discussed in the next section) which includes a focus on innovation. British Columbia however has taken a different approach. The provincial government established the British Columbia Innovation Council (BCIC), an agency that has been charged with enabling innovation. BCIC has interpreted its role as developing entrepreneurial capacity and assisting in commercialization of new technologies (BCIC 2010). This approach targets downstream activities, is economic driven only, and is consistent with the definition of innovation as an output (Bercovitz & Feldman 2005; Hamel 2003).

The Conservative Government of Canada has changed the overall Innovation Strategy developed by the past Liberal Government to a Science and Technology Strategy. Unveiled in May 2007, this strategy is a priority for the government. Its focus is on promoting world class excellence in basic and applied research, focusing on priority areas of opportunities for Canada, encouraging partnerships among research, government and industry partners and enhancing accountability for investment made in this strategy (Industry Canada 2007). Enhancing accountability puts pressure on innovation to perform and therefore it can be assumed that downstream activity (commercialization) is of key importance. In addition, the shift from an innovation policy that guides other departments to a science and technology policy also puts in question the federal government's commitment to innovation or its expectations.

The second definition of innovation puts emphasis on a process or system. Holbrook and Wolfe, in their study on innovation systems for the Canadian Innovation Systems Research Network, define innovation as a *"social process, in which new products and processes emerge out of the ongoing interaction among a range of actors"* (Holbrook & Wolfe 2005) p.109. This definition focuses on the system or process

and not on the outcomes. The outcomes are mentioned but they are not a primary focus of their concept.

The Coalition for Action on Innovation in Canada, a group comprised of fifty-six representatives of the actors of innovation including business leaders, presidents of leading research universities and institutions, support the notion of innovation as outcome focused but resulting from a process (Staff Reporter 2010). The Coalition's definition of innovation is *"creating value through ideas"* that result in wealth creation and a competitive advantage for the country (Manley & Lucas 2010) p.1.

An additional component however is added to the concept of innovation. The Coalition argues that attitude must be considered a critical consideration in the definition of innovation. It defines attitude as *"entrepreneurial: it welcomes risk; it learns from failure; it celebrates success"* (Manley & Lucas 2010) p.1.

Whether there is a lack of understanding of the concept of innovation or the choice is to focus on economic returns, research is being undertaken in Canada to gain a better understanding of the systems of innovation in the country. The National Research Council (NRC) and the National Sciences and Engineering Research Council of Canada (NSERC) have invested in five networks (the network itself plus four regional nodes) which comprise the Innovation Systems Research Network. It was launched in 1998 with the purpose of understanding the impact of various factors influencing innovation and regional economic development. A second major project was launched in 2006 that focuses on understanding knowledge flows within city regions with particular focus on social dynamics of innovation, creativity and social inclusion, and civic governance (ISRN 2007).

2.4.2 Why is innovation important to Canada?

The literature points to two key benefits of innovation for Canada: economic and social. The economic benefit however is the predominant theme.

Innovation is perceived in Canada to be one of the cornerstones of economic success (Herath et al. 2008) and the foundation of economic and social public policy (Holbrook & Wolfe 2005). These points are consistent with the literature that discusses innovation in general terms (Davila et al. 2006; Department of Trade and Industry UK 2003; Dobni 2006; Etzkowitz 2005; Freeman & Louca 2001; Hamel 2003; Rheaume et al. 2006).

Gray and Weseen also argue that innovation is important to Canada as a foundation for international competitiveness and growth of the economy. Their key argument is aligned with that of Lynch, as noted in the previous section, that innovation is required to increase productivity of the country. They define productivity as *"producing more output (as measured in quantity and quality) with the same quantity of resources"* (Gray & Weseen 2008) p.3. They provide as their example that innovation in agriculture has increased agricultural production, decreased labour inputs and decreased food prices.

The Conference Board of Canada however notes that Canada lags behind in productivity growth to that of leading nations in innovation such as Switzerland, Ireland, the United States and Japan (Conference Board of Canada 2010).

Gray and Weseen, Lynch and the Conference Board of Canada's concern over productivity is consistent with concerns in other regions. In his report to Finland's Prime Minister in 2006, Georghiou argued that falling productivity in comparison to other nations and regions must be a key driver for new approaches to innovation policy (Georghiou 2006).

Social benefits also result from innovation. Agricultural innovation in Canada has resulted in benefits such as a safer food supply and has addressed environmental issues (Gray & Weseen 2008).

2.4.3 Who are the actors involved in innovation in Canada?

Following the concept of Etzkowitz' triple helix twins of innovation (Etzkowitz, 2004) as identified in Chapter One, four main actors are involved in innovation in Canada: government, university/research community, industry and the public.

Government

As identified previously, the federal government and most provincial and regional jurisdictions have developed innovation strategies, either to lead their various governments or at the department level.

From the federal perspective, Industry Canada leads the way for the overall Government direction on innovation through the Science and Technology Strategy released in May 2007.

Industry Canada facilitates much of the research conducted in Canada by funding agencies such as the Canadian Foundation for Innovation (CFI), National Research Council of Canada, the National Science and Engineering Research Council (NSERC) and the Social Sciences and Humanities Research Council of Canada (SSHRC).

Canadian policy supports innovation and systems of innovation and is demonstrated by the establishment and ongoing support of the National Research Council of Canada of eleven clusters, one in each of nine provinces and two in Saskatchewan. The focus of each cluster differs, from the fuel Cell and Hydrogen Technologies Cluster in Vancouver, British Columbia, to an Aluminum Transformation Cluster in Saguenay-Lac-St-Jean, Quebec. Three clusters support innovation in the health and nutrition sector: 1) the Plants for Health and Wellness Cluster in Saskatoon, Saskatchewan; 2) the Life Sciences Cluster that includes the Institute for Marine Biosciences in Halifax, Nova Scotia; and 3) the Nutrisciences and Health Cluster in Charlottetown, Prince Edward Island (NRC 2010).

Holbrook and Wolfe argue that innovation systems must focus on the sharing of the knowledge and learning which can be achieved through the establishment and support of local infrastructures such as clusters. The clusters they argue allow for the development of specialization of knowledge which leads to new products, services, technologies and processes (Holbrook & Wolfe 2005).

The Canadian Foundation for Innovation (CFI) is considered to be the single most important vehicle for innovation in Canada (MacKinnon 2005). The mandate of CFI is to strengthen research capacity in Canada. It is the only major fund in Canada that funds capital projects for research. For example, it provided $56.4 million towards capital costs to build the Canadian Light Source, Canada`s only synchrotron (CLS 2007) and largest science initiative. CFI has also funded over two thousand research chairs at various universities and research hospitals and institutes. In total, CFI has invested $5.32 billion in building research capacity in Canada since 1997 (CFI 2010).

Other federal departments have included a focus of innovation as well within their mandate and programs. With respect to agriculture, AAFC currently operates under the Growing Forward policy framework that came into effect in 2008 and will run until 2013. This cost shared program with the provinces provides $1.3 billion over the

five-year period to the agriculture and agri-food community. Innovation is one of the principles of the framework and will be discussed in Section 2.5.3 (AAFC 2010b).

Other programs that were announced by AAFC in 2007 are the Agriculture Bioproducts Innovation Program (ABIP) and the Agri-Opportunities Program (AOP). ABIP is valued at $145 million to fund new and existing science and innovation networks focused on developing and commercializing new biomass products and technologies. Nine networks have been funded that link university and government research institutes and industry. The funded networks are: Cellulosic Biofuels Network; Sustainable Cropping System Platforms for Biodiesel Feedstock Quantity and Quality; Canadian Triticale Biorefinery Initiative; Feed Opportunities from the Biofuels Industries; Industrial Oil Seed Network; Natural Fibres for the Green Economy Network (flax and hemp); Pulse Research Network; and the BioPotato Network: A Canadian network for potato-based bioproducts (AAFC 2010c).

Universities

Innovation entails knowledge creation, diffusion and transformation (Munn-Venn 2006). Baber however argues that universities have entered a second academic revolution. The revolution is a transition from a focus solely on the creation of knowledge to an expectation of transformation of new knowledge into new products and processes that result in economic benefit. Thus universities have become partners in innovation. He argues that critics of this transition believe that industry is now driving research agendas at universities (Baber 2005).

Many Canadian university researchers are part of those critics. Most government funded research in Canada requires matching funds from private sources. In a letter to the editor of the Journal of Science published by the American Association for the Advancement of Science, forty Canadian researchers from sixteen different Canadian universities and research institutions argue that co-funding will direct research at the cost of basic research (Tyers et al. 2005). These Canadian researchers argue that their work is based on funds available, their ability to write proposals and gain third party funding. Research in these instances therefore may be considered project driven and lack consistency of focus. It could be argued therefore that Canada`s approach may be in conflict with its goal of building knowledge capacity, the very foundation of an innovative culture.

Funding sources alone do not drive the nature of innovation. Advances in science and innovation are increasing at an increased rate. Research has become so

specialized that it is difficult for any one researcher to be knowledgeable in all areas. Just as business has recognized the value of cross functional teams, universities and research institutes have not only recognized the value of collaboration across disciplines and institutions but also the need for it (Lussier 2005; Sankaran 2005). Inter disciplinary and inter institutional research provides access to highly specialized equipment, new perspectives on research and access to globally recognized researchers. These activities often result in the development of cutting edge knowledge (Munn-Venn 2006).

An example of such a collaboration is the Advanced Food and Materials Network (AFMNet) administered at the University of Guelph. AFMNet is a national network of scientific researchers throughout Canada. Its goal is to increase knowledge capacity and find solutions for improving food products and biomaterials. In order to achieve the expected outcomes, researchers from many disciplines work together to address specific areas of focus such as functional foods and natural health products.

The Institute of Nutraceuticals and Functional Foods (INAF) based at Laval University is another example that links over sixty scientists of varying disciplines across Quebec to address areas such as human nutrition, proteomics, medicine and food technology.

The Innovation Systems Research Network (ISRN) is another example. It was established in 1998 through the support of government funded programs in the National Research Council, the Social Sciences and Humanities Research Council and the Natural Sciences and Engineering Research Council. The ISRN links researchers throughout Canada to conduct multidisciplinary research to better understand the systems of innovation, their inputs, dynamics and impacts. The goal is to provide evidence that will inform policy-making in Canada (ISRN 2007; Holbrook & Wolfe 2005).

The challenge for funders is that due to the increasing specialization of research, collaboration across provincial and national borders is required. Issues of ownership of the resulting intellectual property as well as who will derive benefit will be issues that will increasingly come to the forefront.

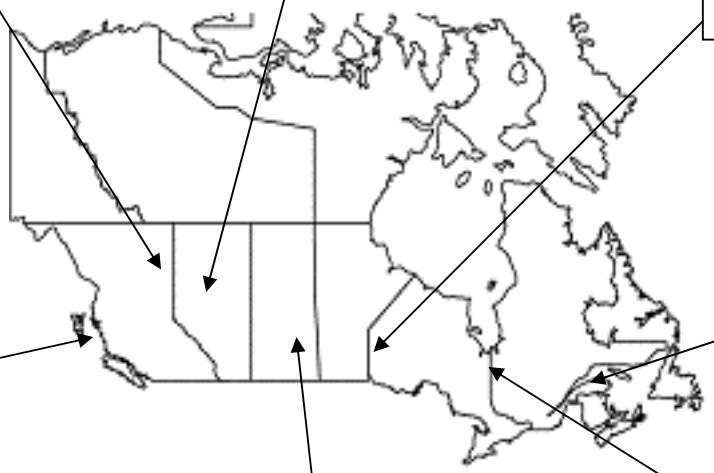
Regardless of the issues and concerns, universities and other research institutions are pressured to realize economic benefit from research conducted. To facilitate the

economic spin-off from universities and other institutes, research parks such as Innovation Place at the University of Saskatchewan and Discovery Park at Simon Fraser University have been established and are affiliated with most research focused universities. These parks not only support the spin-off activities of universities but also attract private industry with the goal of strengthening ties between researchers and industry. Lynch argues however that the relationship between university and industry actors in Canada is weak resulting in a poor performance of commercialization of research in the country (Lynch 2010).

Knowledge is at the core of innovation and therefore by its very nature, universities should be synonymous with innovation. It may be more appropriate however to identify this actor as publicly funded research institutes and centers for learning rather than universities.

In addition to universities in Canada, research and creation of new knowledge occurs at colleges such as the Nova Scotia Agricultural College in Nova Scotia, Niagara College in Ontario and Olds College in Alberta. In addition, publicly funded research occurs in the various institutes of the National Research Council across Canada as identified previously. As well, AAFC has nineteen research centres including the Potato Research Centre in Charlottetown, Dairy and Swine Research Centre in Lennoxville and the Cereal Research Centre in Winnipeg to name just a few. Provincial governments also invest in knowledge creation at provincially funded food centres or processing plants. Figure 18, while not all inclusive, attempts to provide an overview of the activity of the publicly funded research clusters across Canada focusing on agriculture and agri-food.

Figure 18: Canadian agriculture and food research and development clusters



Alberta
- Universities of Alberta Calgary & Lethbridge
- Alberta Research Council
- Alberta Agriculture
- Alberta Food Development Centre
- Olds College

Saskatchewan
- University of Saskatchewan
- POS Pilot Plant
- Sask. Food Development Centre
- AAFC – Saskatoon Research Centre
- NRC – Plant Biotechnology Centre and the Plants for Health and Wellness Cluster
- Canadian Light Source
- Innovation Place Bioprocessing Centre
- Vaccine and Infectious Disease Organization

Ontario
- AAFC – Southern Crop Protection & Food Research Centre, Greenhouse & Processing Crops Research Centre, Eastern Cereal & Oilseed Research Centre
- University of Guelph – Advanced Foods & Materials Network; Centre for Functional Foods, Human Nutraceutical Research Unit National Health Products Technology Centre; Guelph Food Technology Centre
- University of Western Ontario Centre for Human Nutrition
- University of Toronto

Atlantic Provinces
- Memorial University
- University of Moncton Food Research Centre
- University of Prince Edward Island
- NRC – Institute for Marine Biosciences and the Life Sciences Cluster
- NRC – Institute for Nutrisciences and Health
- AAFC Atlantic Food & Horticulture Research Centre; Potato Research Centre
- Prince Edward Island Food Technology Centre

British Columbia
- AAFC – Pacific Agri-Food Research Centre
- University of British Columbia
- British Columbia Institute of Technology

Manitoba
- University of Manitoba & the Richardson Centre for Functional Foods & Nutraceuticals
- Natl. Centre for Agri-Food Research & Medicine/St. Boniface
- Cereal Research Centre
- Manitoba Food Development Centre

Quebec
- McGill University Phytochemical Metabolism Group
- Institute of Nutraceuticals and Functional Foods – Laval University
- AAFC St. Hyacinthe Research and Development Centre; Dairy and Swine Research Centre

Source: adapted (Hodgins et al. 2004)

Industry

Industry is interested in the outcomes of innovation to maintain or increase its economic well being. Industry in Canada's bioeconomy can be defined either as company specific or through industry associations such as commodity on sector specific groups: for example the Dairy Farmers of Nova Scotia, the Canadian Vintners Association or the Canadian Health Food Association.

Large companies like Dow Canada or Maple Leaf Foods have internal innovation activities utilizing their own researchers. Maple Leaf Foods Inc., Canada`s second largest food processing company (Burn 2010), established its own food innovation centre in Mississauga, Ontario. The company's $12 million investment is expected to accelerate innovation in its meat and bakery lines with the goal of bringing new products to the market (Kuhn 2007).

Describing innovation at the industrial level in the Canadian bioeconomy would not be complete without identifying Iogen Corporation of Canada. The company was founded in 1974 and has invested over $85 million since its inception to develop and produce patented enzymes that allow for the production of environmentally friendly products such as paper and clothing. Its primary focus however has been its innovative research that has resulted in the production of bioethanol from biomass (waste components of crops) rather than from the food producing component. Royal Dutch Shell Group now owns twenty-two percent of the company (CIHR 2006).

Ocean Nutrition Canada (ONC) is an example of a smaller company that also does in-house research and development as well as partners with research institutes to achieve its innovation goals. The company is based in Nova Scotia and is a spin-off of its parent company, Clearwater Seafood, a global seafood company and Canada's twenty-sixth largest food manufacturing company (Burn 2010). ONC began its journey by developing products from the waste materials of its parent company. The company has evolved from producing fish oil supplements to microencapsulation of fish oil that can be incorporated into food products. The company`s fish oil ingredient MEG-3 ™ is now being incorporated into such products as Farmers Choice Partly Skimmed Milk and Danone Canada`s Cardivia yoghurt (justfood.com 2005). According to its website, ONC now boasts of being the top global supplier of omega-3 EPA/DHA.

The small companies in Canada however do not have the funds to undertake internal research. Their research activities are often conducted at universities or other research institutes. This method is also used by the associations and commodity groups such as the Saskatchewan Pulse Growers who contribute levy revenue to the Crop Development Centre of the University of Saskatchewan to develop new pulse varieties.

Most Canadian universities and research institutes have policies that ownership of all intellectual property developed at their institutions belongs there. Companies that can afford to are therefore bypassing the research community in Canada and contracting researchers in other countries that are not stifled by those policies. The concern is that once the research is conducted in other jurisdictions, then the benefit may be derived there if manufacturing facilities are established near the researcher.

The issue of intellectual property and patents however has shifted. Almost half the companies in the British Columbia functional food and natural health products' segment are utilizing trade secrets rather than patents or licensing of technology (Hodgins & Fitzpatrick 2007). Herath et al. also came to that conclusion. They note that *"developing and capturing value from FFN* [sic] *innovations is less likely to be based on intellectual property and more closely related to rapid product development and distribution"* (Herath et al. 2008) p.209.

In order to meet each other's innovation goals, collaboration among and between actors are growing. Non traditional collaborations are also occurring. The Canadian Institutes for Health Research partnered with Kellogg Canada in what was determined to be an innovative, non traditional collaboration to include pedometers in boxes of Special K cereal in a 2004 campaign termed Canada on the Move. The objective of the campaign was to raise awareness of Canadians to the need for physical activity. The results of the campaign were measured. The study found that Canadians' awareness of the need to be active as well as ownership of pedometers did increase (Craig et al. 2006).

2.4.4 Who benefits in Canada?

As funding for universities has tightened recently, administrators have eyed the potential of increasing revenues through the commercialization of innovative research developed on campuses across the country. The thought of another Gatorade that has garnered US$80 million for Florida State University since its

introduction in 1973 has spawned the establishment of industry liaison offices at the majority of universities and research institutes to assist researchers commercialize their new products or technologies (Kays & Phillips-Han 2010). Most universities in Canada have either partial or complete ownership of any intellectual property developed in their organization and so are anxious to either license innovative technologies or spin-off companies where the university would retain a percentage of ownership and therefore future earnings.

Coleman et al. argue that the main issue in innovation is the control of its application (Coleman et al., 2004). While research institutions and industry struggle over control of intellectual property, the research agenda is driven by government and industry. The Government of Canada has stated in the Science and Technology strategy that support will be given to priority areas of government. It also requires matching funding from industry. From the perspective of AAFC, this approach is likely to remain unchanged. Through the Growing Forward agricultural policy framework noted above, AAFC stated that a lesson learned was that innovation is *"knowledge-driven and market-lead"* (AAFC 2006). Discovery as a result of basic research may be increasingly difficult in Canada.

In addition, Niosi and Caicedo argue that universities do not provide economic benefit as a result of spin-off companies. Their study showed that very few university spin-off companies in Canada have reached the status of a large company (as defined in Canada by providing employment for over one thousand people). And those that have are in software development such as Research in Motion. Interestingly Niosi and Caicedo's study identified biotechnology as the foundation for the majority of spin-off companies in Canada (Niosi & Caicedo 2005).

Over a third of the companies in the study of university spin-off companies employed less than one hundred people (Niosi & Caicedo 2005). While the benefit of innovation appears to be measured in economic or economic development terms, a company of one hundred people is hardly insignificant in most provinces and territories in Canada particularly when a significant portion of an innovative company is deemed to be comprised of highly qualified people.

Within the demand network which represents industry from primary production through to the retailers, power is shifting to the global retailer. While producers are working their fields utilizing high technology computers on wheels, there is no

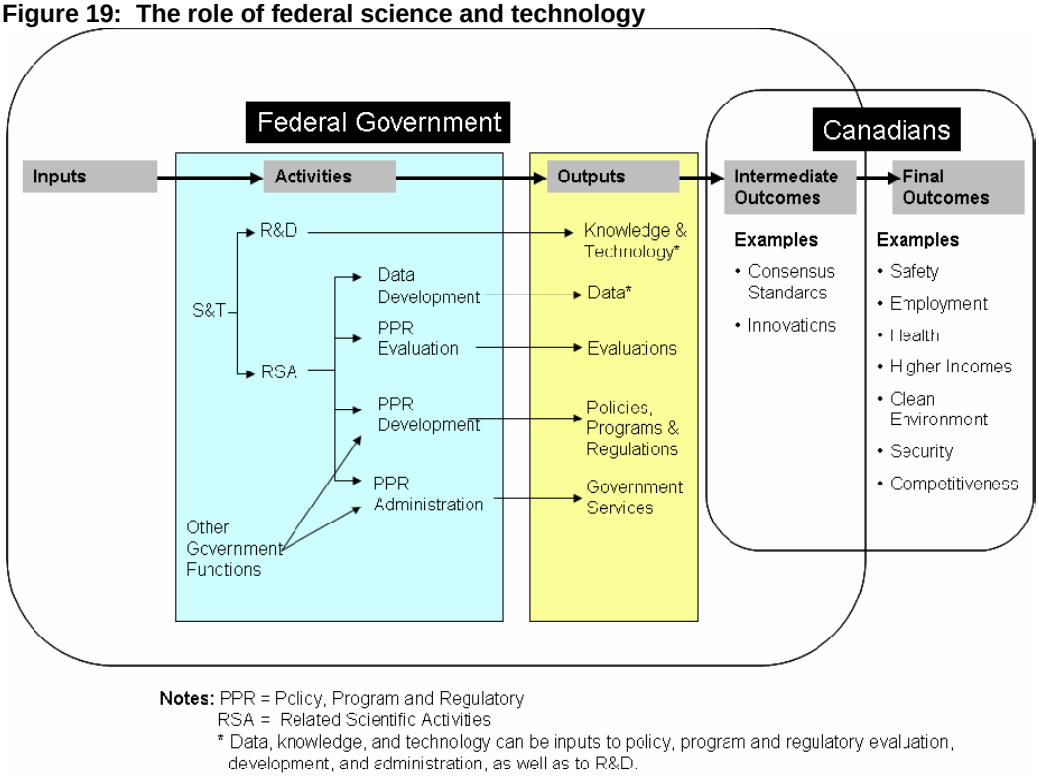
indication that they have reaped increased margins on their production. The benefit appears to be going to the large retailers.

From the Canadian perspective, consolidation across industries has meant ownership relinquished at the regional and often the national level. As multinationals purchase companies in Canada such as New York's NBTY purchase of British Columbia's Sisu Inc., a leading Canadian natural health products' manufacturer, the benefit of innovation at that company is now derived outside of the country.

From the perspective of public investment in innovation, the key goal is that the citizens of the county benefit. Figure 19 below presents an overview of the expected role that the science and technology framework will take in making a difference in lives of Canadians. The figure also demonstrates the interconnection between investment in research and development and the policies, programs and regulatory environment that must accompany it to achieve the targeted outcomes.

Also of interest in this diagram is the notation of 'innovations' under intermediate outcomes. This point demonstrates the premise of Industry Canada's Science and Technology Policy that innovation is an outcome rather than a system.

Figure 19: The role of federal science and technology



Source: Painter 2010

Public scrutiny of government spending has come to the forefront of concerns throughout the world with the economic crisis that occurred during the latter portion of the last decade. The Government of Canada is called on to ensure that public funding in the amount of $5 billion in science and technology annually results in public benefit (Policy Research Initiative 2010).

There must be a good understanding of how benefits are envisioned and thus measured to really understand the question of who benefits from innovation in Canada. Coates argues that an appropriate vision for Canada must be developed based on Canadian values to understand how and who can benefit from innovation. He makes the point that innovation strategies in Canada are responses to real and perceived crises as a result of global transformation in supply networks and the fear of the economic power shift to China (Coates 2005). The unintended consequence therefore is an unbalanced focus on economics and not enough on areas of social justice (Coates 2005).

2.4.5 Is Canada innovative?

The World Economic Forum (WEF) ranks counties in their ability to compete. Countries that develop new products and processes utilizing cutting-edge technology gain a competitive advantage in that global marketplace (Lopez-Claros et al. 2006b; Sala-i-Martin et al. 2009). From a competitiveness point of view, the WEF ranked Canada twelfth out of one hundred and thirty-three countries in 2009-2010 (Sala-i-Martin et al. 2009) up from sixteenth in 2006-2007 (Lopez-Claros et al. 2006b).

On the surface, the news for Canada appears positive. But based on their analysis, the authors of the 2009-2010 WEF report argue that Canada is at a competitive disadvantage in four of the seven factors measuring innovation. These factors are: "*capacity for innovation … company spending on research and development … university-industry research collaboration … government procurement of advanced technology products".* The three factors of innovation where Canada has a competitive advantage were identified as *"quality of scientific research institutions … availability of scientists and engineers … utility patents"* (Sala-i-Martin et al. 2009) p. 129.

While the WEF ranks Canada twelfth, the Conference Board of Canada (CBOC) gives the country a lower ranking of fourteenth of seventeen developed nations examined. Its low ranking is based on the country's poor performance on capacity for innovation which utilizes criteria of *"knowledge production, the transformation of knowledge and market shares of knowledge-based industries"* (Conference Board of Canada 2010).

The CBOC argues that the countries who are leading in innovation have developed innovation strategies for the nation. As was noted previously, Canada's innovation strategy morphed into a Science and Technology strategy in 2007 leaving innovation strategies and policies to specific departments and provinces.

Regardless of the reason, Canada has not met its goal of ranking fifth in innovation by 2010 as was the target, stated by the President of the University of Saskatchewan in 2005 who was at the time, Chair of the Association of Universities and Colleges of Canada (MacKinnon 2005).

One measure of innovation is entrepreneurism which is marked by the willingness to accept risk. This factor represents a major barrier for Canada with respect to

innovation as Canadians are risk averse, particularly compared to Americans (Coates 2005). Coates' point has merit. Canadian companies have difficulty in securing American investment because they are not perceived to be risk takers, a business feature that is deemed critical by Americans. As well, Americans often perceive Canadian businesses as too dependent on government. Rheaume et al. found in their study for the Conference Board of Canada that the most innovative companies in Canada were medium-sized to large companies, collaborating with international and global partners, and the least dependent on government programs and subsidies (Rheaume et al. 2006).

Another issue for consideration when discussing Canada's innovativeness is the country's diverse nature due to its size and dispersed varying resources. These factors emphasize the critical importance of regionality with respect to innovation. A study conducted for the Innovation Systems Research Network of Canada found that there were distinct differences between systems in Western Canada and those in Ontario and Quebec. The authors recommended further research however to clarify those distinctions and the effectiveness of innovation in the various regions (Holbrook & Hughes 1998).

With respect to the food system, Gray and Weseen argue that innovation in agriculture has played a critical element in Canada's economy. *"Innovation in genetics, products, practices, processes and institutions have allowed the sector to increase both the quantity and quality of products available to consumers, while freeing up labour, land and other resources for use elsewhere in the economy"* (Gray & Weseen 2008) p.2.

Herath et al., researchers at the University of Guelph, undertook a study to identify the drivers of innovation in the functional food and natural health product sector in Canada. They argue that while there has been work undertaken to examine innovation in the food system in general, there has been little research in the area of what they term *"advanced food innovation"* p. 207 particularly with a Canadian or North American focus. While the authors do not define the term advanced, they note specifically the inclusion of functional foods and natural health products under the concept (Herath et al. 2010).

2.5 Policy

2.5.1 Defining policy in Canada

Pentney argues that policy-making is all about gaining the public trust, and Canadian citizens wish to set the policy agenda on areas of importance to them. These areas however change over time. Currently the demand for accountability in government is now driving policy-making in all departments of government. Pentney goes on to argue policy on the other hand should flow from the ideals for which the country stands. Canada however has not debated those ideals (Pentney 2006).

The disparate nature of Canada poses a challenge for debating the ideals or values and developing policies that are consistent with them. Canada's policy-making is challenged by the diverse nature of population concentrations, varying levels and sheer numbers of governments, departments and their responsibilities, policy-making expertise capacity and the strength of various sectors in regions of the country (Coleman & Skogstad 1990a).

Accountability however remains a key theme. As it applies to academic research, Niosi agrees with the Pentney's assessment. He claims that governments want assurance that public investments in academic institutions provide a benefit (Niosi 2005), in other words, a focus on accountability.

Accountability however is just one of four priority areas of the government of Prime Minister Stephen Harper. The pillars upon which the conservative government are focusing attention are accountability, security, environmental protection and strong economic management (Harper 2006).

Policy with respect to the Canadian food system has traditionally focused on agriculture as opposed to a food policy. As well, it has been reactionary focusing on *"pragmatic responses to specific problems and issues within the industry"* (Tyrchniewicz & McDonald 2007) p.14.

At the outset of the establishment of Canada as a nation in 1867 and into the early 20th century, policy for this sector of the economy focused on nation building and settling the land and was therefore within the domain of the federal government (Pentney 2006; Winson 1993). Skogstad argues that into the middle of the last century, agricultural policy only *"received attention to the extent that it affects the*

political livelihood of the government" (Skogstad 1987) p. 47. As a result, policies did not address the root causes of challenges faced by the agricultural community. Debates among the communities affected were fierce and disruptive (Tyrchniewicz & McDonald 2007).

By the 1970s, provinces were promoting their own economies and economic development activities. It was during this timeframe that agricultural policy became a shared responsibility between the federal and provincial/territorial governments even though authority was always deemed to be shared based on the British North America Act of 1867 and later in the repatriation of Canada's Constitution in 1987.

Coleman et al. describe three paradigms upon which agricultural policy in Canada has developed. The first is a state-assisted paradigm in which agriculture is deemed critical to the food supply of a nation. During that paradigm, policy focused on protective measures from foreign competitors. The competitive paradigm then evolved where agriculture was perceived as part of a general economy. Policies reflected a philosophy towards a free market although risk management measures were put in place to protect the agricultural community against price depressions in the market. Acknowledging the growing need for and goals reflecting rural sustainability and environmental stewardship, agricultural policy evolved into the multi functionality paradigm. Trade liberalization, protection of intellectual property and food safety are the marks of this paradigm (Coleman et al. 2004).

The paradigms add to the complexity of the demand network and the policy environment in which it operates. It is not a simple case of the agricultural community moving from one paradigm to the other. Just as the country is disparate in nature with varying strengths and level of capacity, so too is the agricultural sector. For example, the red meat sector in Canada operates within the competitive paradigm while jurisdictions have developed policies reflecting the multi functionality paradigm (Coleman 1990).

The bioeconomy and food system that is embedded in it not only fits within the multi functionality paradigm, but is also a stated area of interest for the Conservative government. The result has been new funding for programs addressing specific areas. For example, Canada's Agriculture Minister Chuck Strahl (2005-2007) openly stated that the bio-based economy is a priority for the new government. In announcing the new funding programs such as the $200 million Capital Formation

Assistance Program for Renewable Fuels Production and $145 million for the Agricultural Bioproducts Innovation Program, the government aims to achieve its goal of five percent renewable content in fuels by 2010 (Howard 2006).

It is important to understand why policies are put in place. Unintended consequences can occur. For example, agricultural policies in Canada do not take into account a goal of population health. And yet, the very source of a major contributor to citizen health is the agricultural community (Cash et al. 2004; Lussier 2005; Tyrchniewicz & McDonald 2008).

2.5.2 Policy actors in Canada

The actors in the policy-making environment in Canada are those actors who set policy, and actors who influence policy.

Actors who set policy

People interested in policy in Canada often regard government as a single entity. Sparling argues that the large land mass of the country has resulted in multiple levels of government – municipal, regional, provincial, territorial, federal – all with different policy agendas and tools. This multi-faceted nature of government actors adds tension to the process of decision-making (Sparling 2010a).

This multi-faceted nature of policy-making in Canada is reflected in policy affecting the food system. The federal and provincial or territorial governments as well as some municipal or regional governments are all policy actors. The various departments of agriculture such as the federal AAFC or its provincial/territorial counterparts (e.g. the Quebec Department of Agriculture, Fisheries and Food or Newfoundland's Department of Natural Resources) are the departments that have primary responsibility for agriculture at all levels of government.

The federal government still maintains considerable control over agricultural policy although it is a shared responsibility between the federal and provincial/territorial governments. The control has led to considerable tension between the federal and provincial jurisdictions over the years as provincial departments believe the federal department to be off-loading its responsibilities to the regions.

The various departments of agriculture set policy primarily in the area of programming. The federal department of Health Canada sets policy in regard to the

regulatory controls over areas such as novel foods, natural health products, labelling and health claims.

Environmental responsibilities encompass federal and provincial departments such as the two federal departments of Environment Canada and Natural Resources Canada. Many of the departments work together on specific initiatives. AAFC for example is working with these two departments to meet Canada's 2010 target of five percent biofuels' content for cars and trucks (Vongdouangchanh 2006).

In general terms however the provinces/territories hold greater jurisdictional control over the country's economic and social sectors than their federal counterparts (Howlett & Newman 2009). Head notes that this situation, as in other countries with varying levels of government, causes tension due to competing interests in some areas of policy (Head 2010).

As a result of the diverse nature of Canada as noted in the previous section, Coleman and Skogstad argue that policy-making in Canada is not holistic but rather multifaceted. This observation translates into inconsistent strengths in policy-making within governments or regions. They note for example that Newfoundland has strong policy capacity in fisheries while British Columbia's policy-making strength lies in the forestry sector (Coleman & Skogstad 1990a).

Coleman and Skogstad continue by arguing that policy must be examined through the eyes of capacity and autonomy in the state: capacity referring to available resources to develop objectives and implement policies to meet those objectives; autonomy referring to independence in making those policies, away from the influence of society. The dispersion of responsibilities for policy as is the case in Canada weakens the country's capacity. As a result, policy objectives are difficult to achieve in a cohesive manner (Coleman & Skogstad 1990b).

Howlett and Newman conducted a study measuring analytical capacity in Canada's multi-tiered level of governance. They identified approximately ten thousand policy analysts serving the country's population of over thirty-three million people, with over half of the analysts working at the provincial or territorial level (Howlett & Newman 2010).

These researchers found a significant disparity in the level of analytical capacity between the federal and provincial/territorial governments. They also found that the provincial/ territorial analysts spend the majority of their time trouble shooting and lacked: 1) the knowledge and experience in the areas in which they were developing policy; 2) training in analytic skills; and 3) resources to carry out the job. They argue that this must be rectified (Howlett & Newman 2010).

Howlett also argues that the level of analytical capacity at the federal level varies between and among departments although should be considered at an acceptable level (Howlett 2009). He also points out that the Canadian government continues to make an effort to improve the balance across the federal system regarding building capacity in the area of policy analysis that reflects a horizontal and contextual framework for analysis. But he also notes that Canada has moved to a focus on policy performance leaving the actual decision-making in the hands of the Prime Minister and the Minister of Finance (Howlett 2009). The impact of this shift is that policy decisions are lengthy and a drag on areas that require swift decisions.

Actors who influence policy

The actors who influence policy are found throughout the demand network from farm groups, non government organizations, policy institutes, researchers and non Canadian policy-makers and interest groups.

Commodity groups have taken the lead position as the influencers in primary agricultural policy over the attempts of farm organizations such as the National Farmers Union and the Canadian Federation of Agriculture (Coleman et al. 2004). Skogstad identifies the Prince Edward Island potato growers and the western cattle producers as being particularly successful in driving wedges between levels of government and hijacking policy that they believe do not meet their needs or interests (Skogstad 1987).

Winson also adds a practical viewpoint to the influence of the farming community. The sheer number of producers translates into political power in the voting booth (Winson 1993). While the percentage of producers compared to the general population has been reduced over the years that segment of voters remains strong in many regions such as in Saskatchewan and Manitoba.

Non government organizations that influence policy include a wide range of agencies such as the Consumers Association of Canada to health related agencies such as the Canadian Cancer Society and the Canadian Heart and Stroke Association. These interest groups attempt to influence policy in areas as disperse as high food costs to pressuring for changes in policies regarding food related issues such as trans fat use in the food system.

Other influencers include networks. In 2005, AAFC established five Agricultural Policy Research Networks. These networks are comprised of a multidisciplinary panel of experts that advise on policy. They are also part of AAFC's strategy to increase the country's capacity and abilities in policy. The following networks were established: 1) Innovation Network led by Richard Gray of the University of Saskatchewan; 2) Trade Policy Network let by Karl Meilke of the University of Guelph; 3) Consumer and Market Demand Network led by Ellen Goddard of the University of Alberta; 4) Farm-Level Analysis Network led by James Unterschultz of the University of Alberta; and 5) the North American Agri-Food Market Integration Consortium led by Karl Meilke of the University of Guelph (AAFC 2005b).

Policy institutes such as the Fraser Institute, C.D. Howe Institute, the Canadian Agricultural Policy Institute, the George Morris Centre and the Institute for Research on Public Policy undertake research and offer recommendations to government in policy development that affects the food system.

Zussman conducted a Canadian study on evidence-based policy and found that organizations and researchers providing evidence to policy-makers must do a better job in communicating the evidence in a manner which is understood by the analysts and decision-makers (Zussman 2003).

Howlett however believes that the issue is broader that communications. He argues that only a small number of Canadian business associations and corporations have the capacity to undertake policy analysis. The consequence is that this limits the ability of non government actors to comment on and recommend policy based on evidence. Remarkably, he also notes this is the case within political parties. The consequence is that a high standard of and capacity for policy analysis is even more critical within the public service so that policy failures can be avoided (Howlett 2009).

Policy-making in Canada is also influenced by international agreements such as the General Agreement on Tariffs and Trade now the World Trade Organization and the North American Free Trade Agreement. Implications of these talks and agreements impact Canada's abilities and avenues to assist its farming community. While supply management in agriculture has survived the agreements, tools have changed that assist producers maintain farm incomes. Cohn argues that Canada's ability to fight injustices under these agreements is limited due the relative smaller size of the Canadian economy compared to that of its largest trading partner, the U.S. (Cohn 2005).

From a global food economy perspective, Winson argues that Canada has *"largely been the site of foreign redeployment of capital"* (p. 114) with power over the national food sector now controlled by the U.S. With the transference of power and capital, research and development activities, large food companies are moving their research and development facilities and activities outside of Canada (Winson 1993). The impact of the movement of the private research and development capabilities to the U.S. will impact Canada's ability and capacity to meet the goals of the new Science and Technology Strategy and thus government policy.

2.5.3 Policy mechanism for Canadian agri-food

Three government departments are of specific interest with respect to innovation in the food system and functional foods and natural health products' sector: the Government of Canada's overall policy as it relates to innovation, the agriculture and food framework and Health Canada's food and natural health products regulations.

Industry Canada leads the way for the overall Government of Canada's direction on innovation through its Science and Technology Strategy released in May 2007. The focus of the strategy is on fostering an entrepreneurial advantage, knowledge advantage and people advantage as depicted Figure 20 below (Industry Canada 2007).

Figure 20: Canada's science and technology framework



Source: Industry Canada 2007 p.6

The framework is based on the vision: *"We will build a sustainable national competitive advantage based on science and technology and the skilled workers whose aspirations, ambitions, and talents bring innovations to life"* (Industry Canada 2007) p.6.

The implication of the change from a guiding strategy focused on innovation to one of science and technology implies that innovation springs only from the natural and applied sciences rather than social sciences and that social benefit is realized from economic benefit. This line of thinking is consistent with that of Felt and Fochler (Felt & Fochler 2008).

The agriculture sector in Canada is governed by the Growing Forward Policy Framework whose lifespan runs from 2008 - 2013. The framework is funded by an annual contribution of $1.3 billion committed by the various governments over the five year timeframe and is cost shared with the provinces on a 60:40 basis.

Note that ninety percent of Growing Forward is dedicated to risk management (Sparling 2010a) supporting the theory of path dependency (Segal 2006) to be discussed in the next section.

Growing Forward is guided by the vision: *"Our common vision is for a profitable and innovative agriculture, agri-food and agri-based products industry that seizes*

opportunities in responding to market demands and contributes to the health and well-being of Canadians" (AAFC 2010b). The following table provides an overview of Growing Forward.

Table 4: Growing Forward Agricultural Policy Framework

Vision	Strategic Outcomes	Policy Targets
Our common vision is for a profitable and innovative agriculture, agri-food and agri-based products industry that seizes opportunities in responding to market demands and contributes to the health and well-being of Canadians	A competitive and innovative sector	Accelerate the pace of innovation and facilitate the adoption of new technologies through: • Promoting Agri-Based Innovation Investment Opportunities Program • Science clusters • Innovation commercialization centres • Science to support commercialization of new agri-based products • Supporting the innovative capacity of farmers • Canadian Agri-Innovation Council * • Bioeconomy strategy *
		Enable competitive enterprises and sectors through: • Farm Program Entry and Navigation Platform (FPENP) • Business development • Health claims and novel food ingredients * • Minor use pesticides * • Veterinary drugs * • Support for national organizations* • Enabling research for competitive agriculture*
		Transform Canada's strengths into domestic and global success through: • Brand Canada International Program • Market information and export capacity building • Domestic branding * • Enhancing value chain roundtables * • Canadian Agriculture and Food International Program *
	A sector that contributes to society's priorities	Enhance the safety and security of Canada's food system through: • Food safety systems development • Food safety system recognition • Food safety system implementation
		Promote environmentally responsible agriculture through: • Watershed Evaluation of Beneficial Management Practices (WEBs) II • Supporting on-farm sustainable agricultural practices • Agri-environmental science * • National Land and Water Information Service (NLWIS) • Supporting on-farm sustainable agricultural practices: Technical assistance * • Supporting on-farm sustainable agricultural practices: Federal Priority Beneficial Management Practices (BMPs) * • Environmental performance measurement and reporting *
	A sector that is proactive in managing risks	Minimize the occurrence and extent of risk incidents through: • Developing national biosecurity systems • Developing national traceability systems • National animal and plant biosecurity strategy * • Animal and Plant Scientific Research and Technology Program *

Adapted: AAFC 2010b

* Indicates initiatives funded solely by the federal government

In addition to AAFC's Growing Forward Framework, the department also developed a Science and Innovation Action Plan which "*delivers on key outcomes associated with each priority, both through Growing Forward programming and other science and innovation activates"* (AAFC 2010b). The seven science priorities are:
"1) enhancing human health and wellness through food, nutrition and innovative products; 2) enhancing the quality of food and safety of the food supply; 3) enhancing the security and protection of the food supply; 4) enhancing economic benefits for all stakeholders; 5) enhancing environmental performance of the Canadian agricultural system; 6) enhancing the understanding of Canadian bioresources and protecting and conserving their genetic diversity; and 7) developing new opportunities for agriculture from bioresources" (AAFC 2010b).

As noted previously, the responsibility for policy as it pertains to regulating food, including functional foods and natural health products lies with Health Canada. The Canadian Food Inspection Agency enforces the regulations. Health Canada therefore regulates natural health products under the Natural Health Products Regulations (NHPR) as a subcategory of drugs. With respect to functional foods, they are regulated under the Food and Drug Act, also under the purview of Health Canada.

2.5.4 What are the conflicts?

Policy-making in Canada with respect to innovation and the food system faces many conflicts. They are centered on four areas: the perception of agriculture; the regulatory environment; jurisdictional issues; and actors in conflict.

Perception of agriculture

Agricultural policy in Canada has been perceived as simply that: agriculture and not a system. While policies have attempted to address areas of innovation and social goals, they have been manifested through attempts to deal with the stabilization of farm incomes (Skogstad 1987) and continues to be a major focus of the federal government with little interest in food policy (Tyrchniewicz & McDonald 2007; Vongdouangchanh 2006).

As identified in previous sections, the food system has become a complex network of actors interacting to achieve multiple goals and often at cross purposes. As a result,

agricultural policy in Canada has been reactionary and crisis driven (Tyrchniewicz & McDonald 2007).

Winson offered a somewhat different slant on that view by noting that policy development is *"driven by circumstances"* (Winson 1993) p. 85. Winson identifies the development of policy that established the Ontario Milk Marketing Board under the Milk Act in 1965 in order to reduce the confusion and conflict within and between the channel members in the milk industry.

In addition, agriculture is not deemed to warrant the importance to Canada as other sectors. It is considered to be a *"chronic problem without prospects and with a continuing ongoing threat to the already challenged economic base of rural and small town Canada"* (Segal 2006). Segal argues therefore that agricultural policy in Canada is based on the theory of path dependency. In other words, the policy pathway continues on crisis management with little will to make real change and set a pathway for the food system to be a contributor to Canada rather than a drain on the country's economy.

The regulatory environment

In a study conducted by Herath et al., the researchers found that the current regulatory environment has *"a significant negative impact on the innovative activities"* p.227 of functional food and natural health products in companies wanting the ability to make health claims equal to those made in the United States, although less of an impact on innovation activities on those companies targeting structure and function claims (Herath et al. 2008).

The regulatory environment is complex and difficult. The impact has been that actors in both the public and private sectors are challenged in their ability to be engaged in dialogue on health claims for food and natural health products (Haisley Millar 2008; Hodgins et al. 2004).

Jurisdictional issues

Conflict occurs within and between jurisdictions in Canada. The basis of friction stems from joint authority for agriculture awarded to the federal and provincial authorities by the British North America Act of 1867 and confirmed by the Canadian Constitution of 1987.

Federal agricultural policy has focused on building a nation (Winson 1993) and trade with other nations while the provinces have focused on economic development for their regions. These differing goals as well as different agricultural areas of focus in the five major regions of Canada therefore set the provinces in conflict with each other and with the federal government who must protect the interests of all regions. Skogstad argues that the various foci of agriculture in the regions across Canada have made it all but impossible to set policy that meets the needs of each area (Skogstad 1987).

As well, policy-making has traditionally operated in silos by ministries in economic sectors or functions whose strategies are often in conflict: for example forestry, mining, health, industry, trade and environment. Policies however now require collaboration among the ministries at the federal and provincial levels. Lussier argues that the principle of horizontality is now required to address the complexities of policy-making in the twenty-first century (Lussier 2005).

Coleman et al. agree that collaboration is required. They note that policy-making with respect to agriculture is now being shared with other ministries such as trade, the environment, health and industry (Coleman et al. 2004) not only at the federal but provincial/territorial level as well. For example, the lead agency for science and technology policy (formerly referred to as innovation) at the federal level is Industry Canada. Innovation policy and initiatives to a much lesser degree are also addressed in agriculture through the APF.

Horizontal policy-making is not as easy to achieve as the goal sets out. Turf protection among ministries still exists. Efforts are being made however to attempt to work together. For example, the Alberta Ministries of Innovation and Science and Agriculture, Food and Rural Development worked together in 2006 to benchmark research capacity in that province in food and health. The researchers found that collaboration and communication is sorely lacking and will be a major issue that must be overcome in order to achieve the goal of a healthier population in the province (Fitzpatrick et al. 2006).

Finally, the issue of the desire for political survival at all levels of government sets the stage for conflict at the outset of policy-making (Skogstad 1987).

Actors in conflict

In addition to the jurisdictions being in conflict, nongovernmental actors are also in conflict. Due to their formal and informal role in policy-making, the conflict has resulted from various levels of paradigms within which the actors find themselves.

The red meat sector in Canada is a strong proponent of operating within the competitive paradigm. The dairy sector however wishes to operate under supply management which is directly in opposition with the competitive paradigm while jurisdictions focus on the multi functionality paradigm focusing on rural sustainability and the environment (Coleman et al. 2004).

The National Farmers Union and the Canadian Federation of Agriculture no longer enjoy the status they once had representing the interests of the farming community to the policy-makers. The growing strength of corporate farms as well as regional strengths have given rise to commodity specific groups who are now the stronger voice of the agricultural community.

Cohn notes that other actors in the food system are in conflict with each other as well. He identifies supply management as a source of conflict between specific commodities and organizations such as the Consumers Association of Canada and food processors. Both actors believe that supply management has prevented the reduction of the cost of food or inputs into food manufacturing. Cohn stresses however that the concerns of food processors should indeed be heard due to the importance of food manufacturing to the Canadian economy (Cohn 2005).

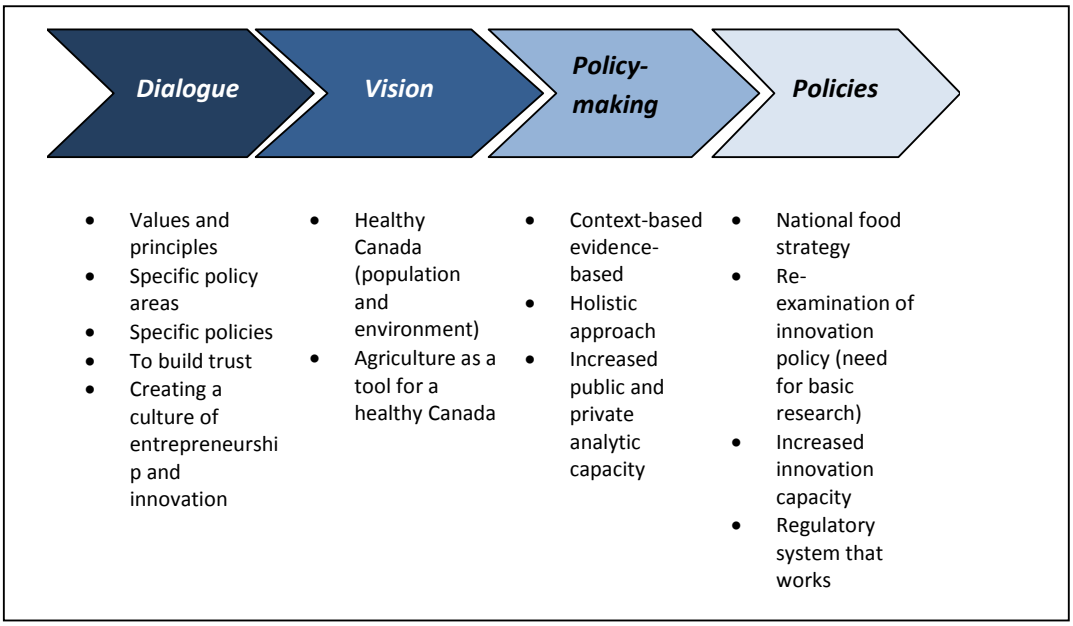
The evolving demand network has also brought non traditional players to the food system with differing and sometimes conflicting goals (Friedmann & McMichael 1989). This area of additional tension will grow stronger if the power in the food system shifts to other Industries.

2.5.5 What is required?

The consistent theme in the Canadian focused literature targets change. Change is discussed with respect to: dialogue; vision; policy-making; and policies.

Figure 21 below provides an overview of the literature of what is required in Canada with respect to policy as it applies to innovation and the agri-food sector.

Figure 21: The call for change in Canada's food system



Dialogue

Dialogue is at the foundation of building a policy environment. Pentney calls for dialogue with the public regarding values and principles for which Canada stands (Pentney 2006). As well, Naylor and Toope's article in the Toronto Globe and Mail is clearly an attempt to engage all actors of innovation in dialogue (Naylor & Toope 2010).

Holbrook and Wolfe recognize the need for dialogue to build trust. They call on policy-makers to be mindful that dialogue is critical among the actors to build the trust required to build local and regional systems of innovation. Their conclusion therefore is that policies that focus on social networking and learning should be enacted (Holbrook & Wolfe 2005). These policies would also partly address Gray and Weseen's call for horizontal and vertical linkages with government, university and industry (Gray & Weseen 2008).

Dialogue regarding other policy areas is also noted. Haisley Millar notes that the regulatory environment is complex and difficult but that a way must be found to

engage both the public and private sectors to discuss areas of interest with respect to health claims specifically (Haisley Millar 2008).

A culture change is called for regarding entrepreneurship and innovation (Coates 2005; Naylor and Toope 2010). As noted previously, Coates argues that Canadians do not have the risk mentality of Americans which he believes is required to translate knowledge into economic and social benefit for the country. He argues that this must change (Coates 2005).

Naylor and Toope agree and have begun the process of engaging all actors of innovation in dialogue with a call for a culture change: *"So it seems logical that a culture of innovation and entrepreneurship should be promoted in all sectors of the economy, not least social agencies, non-profit enterprises, public administration, and postsecondary and health-care institutions. Such a shift depends on long-term planning and sustained effort. There are no short cuts, and quick fixes may do more harm than good"* (Naylor & Toope 2010).

Vision

As noted in the previous section, the literature supports a new vision for the food system. It is one that focuses on health of the nation from both a human and environmental perspective. Agriculture has been perceived over the decades in Canada as a method to attract new immigrants in order to settle a nation, a source of food for the population and also trade that supports the growth of the country's gross national product. It has also been crisis-driven and reacting to the needs of interest groups (Cash et al. 2004; Segal 2006). Technological advances in areas other than primary production to increase yield and lower food costs have resulted in the development of new visions for agriculture.

The new vision for Canadian agriculture sees agriculture not as a distinct entity but rather a tool that addresses the health of the nation from both an environmental and population perspective (Cash et al. 2004; Haisely Millar 2008; Lussier 2005; Segal 2006; Sparling 2010b; Tyrchniewicz & McDonald 2007). The outcome of such an approach is expected to provide Canada with economic, environmental and rural sustainability (Segal 2006). The new vision would be driven by investment in innovation and strengths of the agricultural system (Segal 2006).

There is support for the vision. Sparling argues that while there is significant research linking nutrition to health outcomes, the linking has not translated into policy. He continues that health and food policies have been developed in isolation of each other and argues for a paradigm shift to link the two policy areas. Research/evidence has formed the foundation for a shift from a treatment model to prevention model. Sparling and Cunningham argue however that *"Canada has not been able to capitalize on this research"* (Sparling & Cunningham 2010) p.5. They recommendstherefore that a policy shift must occur in both the public and private sector, individually and jointly, to meet the vision of a healthy Canada that results in both social and economic improvement (Sparling 2010a).

Policy-making

The approach to policy-making in Canada is identified as requiring change. As Sparling and Cunningham point out, the evidence is clear linking nutrition and health (Sparling & Cunningham 2010). This point is supported by other academics as well (Cash et al. 2006; Holub 2002; West 2002). This linkage has significant ramifications on the economy. Cash et al. identified heart disease, cancer, stroke and diabetes as being the diseases linked to nutrition. These authors estimated that the cost to the Canadian health care system was *"an estimated $29.4 billion in direct and indirect costs (in 2004 dollars), or 19% of all Canadian health care costs"* (Cash et al. 2006). And yet, Sparling and Cunningham argue that the evidence linking nutrition and health has not been acted on (Sparling & Cunningham 2010). Cash et al. support the call for evidence-based policy-making (Cash et al. 2004).

Zussman however offers a word of caution. He is supportive of evidence-based policy-making but agrees with other researchers that an evolution is required to include context (Dobrow et al. 2004; Flanagan et al. 2010; Lang 2010; Llerena & Matt 2005; Lomas 2000; Marsten & Watts 2003; Zussman 2003). Zussman examined evidence-based policy-making as it applies to Canada. He noted that Canada must take into consideration the context in which Canada operates in making policy. For example, he points to the relationship that Canada has with its largest trading partner and neighbour to the south, the United States. The impact of policies Canada might enact may have significant ramifications on its trade (Zussman 2003).

Zussman's Canadian study also pointed to the need to consider evidence in context of the overall goal of government. The two may be inconsistent with each other. His study also demonstrated that government is often under time pressure with respect

to problem-solving. Sound evidence often takes considerable time to collect. He therefore noted that *"many policy initiatives require assumptions about the future that are fundamentally untestable. Policy-makers have to carefully weigh predictions about future impacts against the credibility of the sources of the information and their own common sense"* (Zussman 2003) p.69.

Elmslie argues for a more holistic approach to policy-making in Canada. She argues that research in the area of food and nutrition has focused on single areas. An example of this would be the research conducted on folic acid resulting in a policy that allowed for its inclusion in flour. She argues that public health concerns regarding nutrition and health outcomes require a systems approach in the development of food policy in Canada (Elmslie 2010).

Critical to context-based, evidence-based policy-making are the policy analysts. As was noted previously, analytical capacity must be improved in Canada (Coleman & Skogstad 1990b; Howlett 2009; Howlett & Newman 2010). Zussman also sees this as essential not only to Canada but to other countries as well. The goal is to build analytic capacity to interpret and meld scientific evidence from the scientific and social arenas. He also argues that capacity will only be built when these analysts begin dialogue through networking with other actors in and outside government in their own place of work and operations so that issues and context can be understood (Zussman 2003).

Policies

Presidents of two of Canada's leading universities, the University of Toronto and the University of British Columbia, wrote an article in the Globe and Mail on August 27th, 2010 regarding Canada's innovation policy and call for a change in its direction. Naylor (University of Toronto) and Toope (University of British Columbia) argued that federal public policy with respect to innovation has not had its desired effects because it has focused on the wrong areas. First they note that at least in rhetoric there is a move to diversify away from supporting Canada's natural resource sector and the country's economic dependence on it. They argue however that innovation policy should focus on supporting innovation in those sectors, including the agriculture sector (Naylor & Toope 2010).

While public policy aims to support the growth of the high-tech sector, it accounts for only a small percentage of Canadian jobs. Naylor and Toope also argue that public

innovation policy must support private sector research and development activities. They argue that the limited private sector up take of university discoveries is a drag on Canadian innovation. Thirdly, they argue that the Canadian government's push to focus on the support of commercialization towards the market end of the continuum is misguided. Public policy must allow for research at the idea and discovery stage, and not be limited to the natural and applied sciences, if innovation is to flourish in Canada (Naylor & Toope 2010).

With respect to food policy, a national food strategy is called for (Sparling 2010b; Tyrchniewicz & McDonald 2007). While efforts have been made in the past, a national food policy or strategy has never been enacted.

A workshop held at the Richard Ivey Business School at the University of Western Ontario on March 29 and 30, 2010 focused on food and health. It was attended by an invited group of Canada's leading researchers in food and health policy, industry representatives and federal and provincial government policy representatives. One recommendation emanating from the workshop was the development of a national food strategy. While provincial food strategies have been enacted in the provinces of British Columbia and Quebec, a national strategy has been sorely lacking. The workshop set as a goal the creation of a national food and health strategy by December 2011. The strategy would provide economic benefit throughout the food system, social benefit to society by the provision of healthy food options, and environmental benefit through policies that result in a sustainable environment (Sparling 2010b).

Gray and Weseen also call for a change in policy with respect to innovation but as it relates to agriculture. They base their claim on *"slowing rates of productivity growth, underinvestment in research, and poor records of value added commercialization"* Gray & Weseen 2008) p.2. They fear that without changes to agricultural innovation policy, the very survival of the sector is threatened.

Based on their study of best practices in agricultural and food innovation, Gray and Weseen made recommendations to AAFC that would target the goal of increasing Canada's innovative capacity as it pertains to the sector. Their recommendations that impact policy are captured in the table below (Gray & Weseen 2008).

Table 5: Building innovation capacity in Canadian agriculture and food sector

Best practice area	Recommendations that impact policy
International access	1. Continue to be proactive in negotiating reduced barriers to international trade. 2. Harmonize food and pesticide regulation with the United States, and push for more harmonization internationally.
Horizontal and vertical linkages	3. Support industry organizations. 4. Support government and university outreach and engagement with the agricultural industry. 5. Coordinate and sponsor regular agricultural outlook and foresight analysis. 6. Support food and agricultural trade shows.
Building intelligence	7. Coordinate, sponsor and undertake reconnaissance to identify firms and regions that are leaders in specific agricultural technologies, and encourage Direct Foreign Investment (DFI) and immigration of highly qualified personnel. 8. Develop and implement deliberate human resource strategies designed to recruit and educate scientists, social scientists, and entrepreneurs in fields related to agriculture and food.
Investing in science	9. Continue to invest public resources in basic science / biotechnology / genomics. 10. Use more prizes or financial awards for applied agricultural research where research inputs are unknown and targets for outcomes can be described. 11. Spend resources on analysis and coordination to develop Canadian systems of IP protection to maximize national benefits from innovation. This involves the creation of private incentives for research, without creating unnecessary obstacles and freedom to operate issues for other firms and the public sector.
Access to infrastructure	12. The government, working with shippers and the rail industry, should develop the infrastructure and regulatory system to ensure low cost inland access to marine containers. 13. The government, working with industry should develop and maintain high-speed internet access for rural areas.
Crop specific innovation	14. Continue to provide public funding for basic and agronomic research. 15. Implement compulsory producer controlled research levies supported by government incentives. 16. Continue the existing practices of providing public funding for variety testing and record of performance systems.
Food innovation	17. Government should proactively fund research to support health claims, product testing, and registration. 18. Government should proactively fund public new product comparisons. 19. The government should create a policy to assure adequate financial resources (loans programs, equity, etc.) to pay for food innovation and commercialization.
Environment	20. The government should implement a policy to create monetary incentives for carbon sequestration and GHG mitigation in agriculture.

Source: Gray & Weseen 2008.

Other authors have expanded on areas that require attention to increase innovative capacity.

An enforceable regulatory or legal environment is a key measure in setting the stage for innovation within a country or region (Freeman & Louca 2001; Herath et al. 2008; Lopez-Claros et al. 2006a; The Economist 2006). Herath et al. however support the notion of harmonization of Canadian regulations with those of the U.S. They argue that the regulatory environment in Canada has been a drag on innovation in the FFNHP sector. They explain that their research calls for policy change that allows for generic health claims which will increase the number of products in the pipeline. They also argue for the need for policies that assist companies in the development and scale-up of their products that would assist companies in commercializing new products (Herath et al. 2008).

With respect to innovation, rather than a national system of innovation for Canada, Holbrook and Wolfe provide rationale for their support for regional systems of innovation. By focusing solely on policy at the national level, they argue that Canada's geographic and resource diversity will set such a policy up for failure. They argue for a three pronged policy framework for Canada that supports both the supply and demand issues that relate to innovation including the creation of new knowledge and the receptor capability for the knowledge. To meet this goal, they argue that a broad policy mix is required to support increasing innovation capacity and capabilities in the private sector and must include: *"infrastructure policies promoting the rapid diffusion of new technologies across a range of firms; policies building the market for new technologies; and policies supporting the growth of SMEs through increased networking and interaction.* (Holbrook & Wolfe 2005) p. 117. They argue that policies focusing on both the supply and demand side of innovation policies must be addressed to reduce the risk of policy failure.

Holbrook and Wolfe also support Zussman's emphasis on people. They found that a key component of the success of the cluster is the people or as they note, the 'talent'. They argue that the *"geography of talent"* p. 117 attracts private investment and establishment of existing companies into the cluster or region. And secondly, they argue talent attracts other talent or knowledge-based workers which in turn supports the infrastructure that creates new knowledge and applies it (Holbrook & Wolfe 2005).

2.6 Conclusion

Canada was founded as a nation nurturing the land. The farming community that once was important to settling a nation no longer receives the status in the economy of other sectors. The food system in Canada to this point has focused primarily on the production end of the system. Policy in practice in Canada has facilitated that mentality. With regard to innovation, the focus has been on the expected outcomes of higher yields on the farm and producing varieties of crops that can sustain transportation.

Due to global competition and issues, there is an emerging shift in Canada to the concept of the bioeconomy. New areas of research and innovation are focusing on securing the most value from agricultural and marine based raw materials resulting in new high value products that may or may not be food, for example natural health products and bioplastics. The concept of innovation as it relates to high value added products and particularly what Herath et al. refer to as advanced foods is not understood (Herath et al. 2005).

While the numerous areas of government in Canada espouse innovation as a priority and have developed strategies that support it, it is unclear as to how that support can be meaningful for the food system, the emerging bioeconomy and the citizens of Canada. This chapter demonstrated that the literature is calling for change so that Canada can be deemed a leader rather than a laggard in innovation.

The literature also identified the need for context-based, evidence-based policy-making in Canada that is founded on dialogue and a multi-dimensional vision in which the food system plays a role. The vision calls for Canada to be a healthy nation with respect to its people, the environment, its economy and social systems.

CHAPTER THREE - The research process and methodology

3.0 INTRODUCTION

If the concept of innovation is not understood, innovation policy will not be effective. To bring focus to the research to prove or disprove the hypothesis, a segment of the Canadian food system, the functional food and natural health products' sector is examined utilizing the case study method. This sector was chosen as it claims innovation as its foundation and yet Herath et al. found there has been little research to understand innovation in the functional food and natural health product sector (Herath et al. 2010).

Chapter Three therefore outlines the strategy or research design for the field work. It provides an overview of the research options available, the rationale for the pathway followed and the research questions.

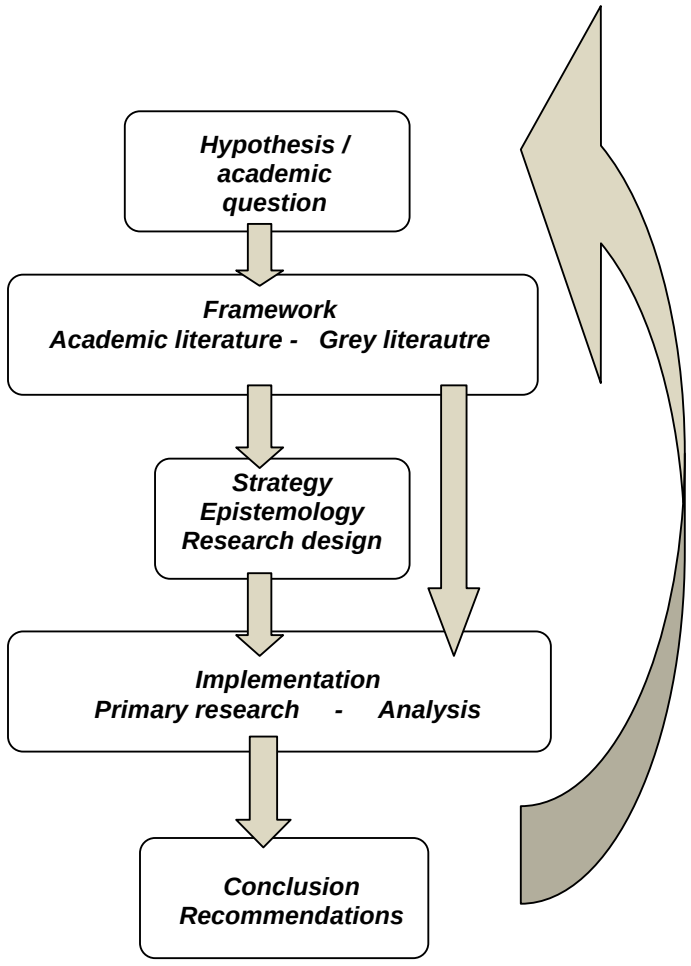
Quantitative and qualitative collection methods were assessed to determine which method best met the needs of the research topic. The aim of the research was to explore the policy environment that enables innovation. Within that exploration is the need for a better understanding of the concept of innovation itself within a specific sector where innovation is not well understood: the functional food and natural health products sector in Canada (Herath et al. 2008). This research therefore sought to add new knowledge to the concept of innovation to provide policy-makers with context-based, evidence-based research for decision-making purposes in the emerging bioeconomy. The research design was formulated to meet that goal.

A total of forty elite, active interviews were conducted targeting four actor groups: industry (Canadian FFNHP companies, traditional Canadian food manufacturers for comparison purposes, multi-national enterprises, and retail), research/academia, government representatives and the public as represented by non government organizations. The interviews also represented organizations across Canada. Note however that with respect to the government representatives, the focus was on the federal government rather than provincial or territorial.

3.1 The pathway forward

Research design is a strategy. It encompasses how the hypothesis or academic question will be addressed. Figure 22 provides an overview of the process undertaken to address the question. It shows that while a pathway is set, the end must be measured against the starting point to assess if the hypothesis or academic question is met.

Figure 22: The research pathway



Both quantitative and qualitative methodologies were considered as options for the research design in the investigation of a policy environment that facilitates innovation

utilizing the Canadian functional food and natural health product sector as a case study. The design is critical as it sets the pathway and the implementation plan for conducting the research. It is designed in such a manner as to be able to answer the research question or questions of the study in as decisive and objective manner as possible (DeVaus 2006). Creswell argues that the choice of methodology depends *"on the nature of the problem or issue, the researcher's personal experience and audiences for the study"* (Creswell 2009) p.3.

The methodology is not usually considered to be mutually exclusive between quantitative and qualitative methods but rather a mixture of the two with more emphasis being on one type (Creswell 2009).

Quantitative Research

Thomas argues that quantitative research focuses on *"measurements and amounts"* p.1 when examining factors being studied (Thomas 2003). King et al. agree and are even more specific. They refer to quantitative research in statistical and numeric terms and measurements which they argue avails the researcher the ability to withstand scrutiny of their peers in generalizing the results of research as it applies to a broader based population (King et al. 1994).

Quantitative research tools include: surveys, experiments, observation, archived data, and interviews (Creswell 2009; Sverke 2007b). With respect to interviews, Sverke adds that quantitative interviews must be standardized so as to allow the responses to be compared in a numeric manner (Sverke 2007b).

The goal of quantitative research is therefore to minimize possible subjectivity in the interpretation of the data and be able to make generalizations on the data based on the results (Sverke 2007a).

Quantitative study methods therefore are most useful when factors can effectively be measured (Thomas 2003). Examples of the factors are the number of people in a household; sales revenues; and distance travelled. Balsley supports this view. He notes that quantitative research reflects a *"scientific"* or *"controlled"* approach to investigate the focus of the query that can be accomplished through the use of tools such as surveys or forecast modelling (Balsley 1970) p.3.

Sverke argues that investigations utilizing quantitative measures have three major features: 1) statistical foundation; 2) results applied to a population based on the sample used in the survey; and 3) application of theory to actual findings (Sverke 2007a).

This method was utilized by Herath et al. in 2008 in their study of factors that influence innovation in the Canadian functional food and natural health product sector. This group of agricultural economists at the University of Guelph utilized the number of new products in the product line of companies in this sector as well as the number of products in development. Their data source was a 2003 Statistics Canada survey (Herath et al. 2008). Since the number of products could be quantified and measured, quantitative research was appropriate for this study.

Qualitative Research

Denzin and Lincoln describe qualitative research as *"a field of inquiry"* p.4 and that this type of research is a *"set of interpretive activities"* p.7 that favours no one method over the other (Denzin and Lincoln 2005). They argue that qualitative research has evolved from the demand for an understanding of the social sciences that is evidence-based to one whose aim is to develop a vision for the type of society that is desired (Denzin & Lincoln 2005).

Qualitative research differs from quantitative research in that qualitative methods focus on understanding complex issues or topics of interests that are not easily measured (Sarantakos 1998). Qualitative methods are used therefore when in-depth investigation is required to gain *"rich knowledge of a specific phenomenon"* (Miller & Salkind 2002) p. 143. The concept of rich knowledge denotes interpretative activity that is consistent with Denzin and Lincoln. It also can infer fluidity and an evolving nature.

Qualitative research refers to the study of phenomena that would be difficult to explore utilizing quantitative methods which are primarily utilized in the fields of applied science. It is also utilized when there is little known about the concept under study and would therefore be difficult to examine using numeric measures (Creswell 2009).

The critical distinction in the literature between the two types of research, quantitative and qualitative, appears to be the debate between measurement (quantitative) of

factors and the interpretation (qualitative) of factors. Maxim however suggests that *"anything that cannot be potentially measured – that is quantified – is metaphysical and is therefore outside the realm of scientific inquiry (try religion)"* (Maxim 1999) p.33. In other words, the two types of research have commonalities and are complementary in nature rather than at odds with each other. The result is that research often combines the two types of research methods depending on the data being gathered and analyzed (Creswell 2009; King et al. 1994; Thomas 2003). While one method is normally predominant, the use of both types strengthens the outcome.

While quantitative measures were used in some instances in the analysis of the data gathered for this study, qualitative research laid the foundation for the research strategy utilized. The literature was consistent with the findings of Arthur as well as Conway and Steward that there is no common agreement regarding the concept of innovation in general (Arthur 2009; Conway & Steward 2009). As well there is little understanding of the concept at all within the realm of advanced foods (Herath et al.). Qualitative measures were therefore deemed more appropriate to secure the rich knowledge required to expand the level of knowledge in this area.

Once the primary research method was chosen as qualitative, then the activities necessary to conduct the research were determined. Denzin and Lincoln argue that qualitative research is comprised of three basic activities: 1) the development of a framework or theory resulting in 2) the epistemology or set of questions that explores the theory through 3) a specified methodology (Denzin & Lincoln 2005).

3.2 The framework

This study revolves around the major theories of the power shift in the global food system to the large multinational retailers and the emerging bioeconomy. The impact has been the emergence of complex, multi dimensional supply chains that are better described as demand networks attracting growing interest and participation of non traditional actors.

The focus in the food system has moved from adding value at the source of production now to food. The impact has been a focus of scientific and technical applications on the food system being driven by the demand side of the equation. New innovative products, processes and enabling technologies that provide

companies with intellectual property rights are sought. This development addresses growing concerns over health and wellness of individuals and society as a whole, the new drivers of the economy.

The concept of innovation and therefore innovative technologies and products is not well understood. And yet it is deemed to be critical to a country's economy. It is described in terms of outcomes as well as processes. Etzkowitz utilizes his theories of the triple helix and the triple helix twins to explain the interconnected relationships of universities, industry, government and the public that are required for successful innovation.

An expanded theory, the systems of innovation, is more inclusive, multidisciplinary and interconnected with other values or variables such as nations and social entities. Jacob's theory lends credence to Castells' horizontal networking theory that demonstrates the importance of social networking in order to thrive in an innovative economy.

Against this backdrop, governments take on an enabling role. The literature review identified that there is a growing call for a context-based, evidence-based approach to policy-making. This approach requires input of experts whose contribution is based on sound research from the social or natural sciences. It also requires analytical capacity in both the public and private sector to assess the evidence in the context of other considerations such as political realities or other information to which researchers providing the evidence may not be privy. With respect to Canada, the literature showed that improvement is required in analytic capacity.

Other areas were found lacking in Canada as well. At its very foundation dialogue within and among all actors is required on topics ranging from the principles upon which Canada stands to policy. Re-examination of innovation policy was called for as was new thinking in agriculture and agri-food. Canada has never had a national food policy. With the growing concern over the health of the nation from the perspective of population, environmental and societal health, the literature demonstrated the need to shift from an agricultural policy to policy that sees agriculture and agri-food as but one tool in a healthy Canada. In other words, the literature calls for a vision for Canada utilizing multi-dimensional strategies.

In addition, little is known regarding innovation in the functional food and natural health products sector in Canada. Policies such as the regulatory system have been identified as drags on innovation. The policies therefore have not had the intended impact. If there is a lack of understanding of innovation, then current policies are likely not founded in evidence. Any positive impact that they currently have, may be serendipitous.

As well, the literature showed that decision-making with respect to policy has been consolidated and is now in the hands of the Prime Minister and the Minister of Finance. The implication is that policy-making in Canada leans more towards context rather than evidence.

This research aims to address a portion of the concerns identified above by providing evidence to policy analysts in the area of innovation in the emerging bio-based economy.

3.3 The epistemology

The major focus for inquiry is adding new knowledge concerning a phenomenon (Denzin & Lincoln 2005; Holstein & Gumbrium 2004; Miller & Glassner 2004; Miller & Salkind 2002). The focus is innovation and the policy environment as it applies to a specific segment of the food system and emerging bioeconomy in Canada.

If the concept of innovation is not understood, innovation policy will not be effective. To bring focus to the research to prove or disprove the hypothesis, a segment of the Canadian food system, the functional food and natural health products' segment is examined utilizing the case study method. This segment was chosen as it claims innovation as its foundation and yet Herath et al. found there has been little research to understand innovation in the functional food and natural health product sector (Herath et al. 2010).

A case study is an in-depth examination of people, organizations, events or programs and offers insight into a special area of interest or phenomenon (Stake 2005). As such, case studies as a methodology are often used to develop a skill set in critical thinking (Alvarez et al. 1990). In multiple case studies, researchers attempt to identify commonalities (Miller & Salkind 2002) or variables that assist in understanding the phenomenon of interest by providing a more holistic understanding (Feagin et al. 1990).

Creswell and Maietta as well as Stake refer to case studies as systems (Creswell and Maietta 2002; Stake 2005). Stake offers further clarification by arguing that the system involves the process as well as the outcome of the process. In other words, case studies can be viewed as a method of inquiry as well as a product and in totality is reflective in nature (Stake 2005). Case analysis therefore concerns examination of past events or actions and attempts to gain insight or explanation through a reflective thought process (Tellis 1997). It is critical therefore that clear criteria are set forth for the selection of the cases to be examined. Interviewees affiliated with the cases are required to have the knowledge and reflective capacity concerning the case to develop their thoughts during the active interview which is part of a case study.

Stake describes three types of cases: the intrinsic case that examines one case that is of interest unto itself; the instrumental case that utilizes the subject to examine a phenomenon; and the multiple case study that draws conclusions about a specific population based on examination of the sample of that population (Stake 2005).

Just as the active interview aims to tap into the experience of the interviewee, so the case study taps into the experience of the actors involved in the case in order to understand and develop new knowledge (Stake 2005; Tellis 1997). The researcher not only interviews the various actors but also examines other information concerning the case such as internal or public documentation. This process is known as triangulation. In the case at hand, triangulation occurred through examining the literature in general as well as how it pertains to Canada and conducting interviews. Stake argues that this multi-pronged process of triangulation in the case study system brings credibility to the outcome (Stake 2005).

Cases are often complex and encompass data and information that is irrelevant to the topic at hand. Stake notes that due to the complexity of cases, data is often included that is not pertinent (Stake 2005) and thus the case is easily diverted to tangents that do not address the phenomenon of study. To ward against that occurrence, Stake as well as Creswell and Maietta argue that case studies must be regarded as bound systems providing limits within which the case is studied (Creswell & Maietta 2002; Stake 2005). It is therefore incumbent upon the researcher to guard against data that adds no value by establishing guidelines or criteria for data that will be analyzed.

Tellis suggests that the cases themselves must therefore be selected carefully to secure information that is of value to the phenomenon of study (Tellis 1997).

The Canadian functional food and natural health products segment is comprised of small and medium sized enterprises and therefore findings of the research should be of interest to countries that are similar in nature. From a policy perspective, Canadian decision-makers are seeking to establish the country as innovative and knowledge-based as its competitive advantage. And similar to other countries, Canada is struggling to maintain a treatment based health care system. Health prevention is increasingly being promoted by all actors.

It is within this environment, linking food and nutrition to preventative health, that innovation and federal policy is investigated. The scope of the research examines the concept of innovation; the drivers of innovation; the current level of innovation in Canada's functional food and natural health products' (FFNHP) segment; and the policy environment in Canada within which the segment operates. The goal of the research is to provide evidence that will inform policy based on a critical review of the literature and an analysis of primary research.

The primary research therefore focused on the following research questions.

The research questions

R1. How is innovation being defined and approached in two segments of Canada's food system: food manufacturing and functional food and natural health products?

R2. What is driving innovation in these segments?

R3. How is innovation measured?

R4. How has Canadian innovation policy framed innovation in the food system in general and has the framework affected growth or restriction of small and medium sized enterprises (SMEs) in one or both of the segments?

R5. What kind of policy framework would assist the growth of innovation in small and medium sized enterprises in Canada in the emerging FFNHP sector?

3.4 The methodology

Denzin and Lincoln argue that qualitative research utilizes various tools in order to gain an understanding of the research focus (Denzin & Lincoln 2005). Primary information gathering focused on tapping into organizational experiences which Silverman notes is *"a prized object"* in qualitative research (Silverman 2004) p. 343.

Since there is no common understanding of the concept of innovation, the assumption is that it is difficult to explore. It is important therefore to investigate its diverse nature with people who can discuss their understanding from a retrospective, personal viewpoint as well as from a strategic pathway forward. Experience, Denzin and Silverman's 'prized object', is therefore key to understanding the very nature of the phenomenon or concept of innovation.

As well, Cresswell argued that the researcher's experience is one of three considerations in determining the research methodology or design (Creswell 2009). In this instance, a significant amount of work in the professional context has been done in the Canadian functional food and natural health product sector with all actor groups. The primary design utilized has been qualitative in nature.

Qualitative research is therefore a valid approach for conducting primary research into this area.

The primary research tool utilized was the interview and is discussed in depth below. While interviews tapped into the experience of the interview targets, experience is often complex given that it is subject to influence from many variables including culture, gender, nationality and education. Researchers therefore often utilize multiple tools to gain a deeper sense of the experience and validate the interpretation of experiences expressed by the object of the research. This tool is known as triangulation (Denzin 1989; Denzin & Lincoln 2005; Fontana & Frey 2005; Stake 2005).

Stake argues that the multi-pronged process of triangulation brings credibility to the outcome (Stake 2005). By comparing the interview findings in the analysis with the academic literature as well as the grey or social literature, the results of this study are strengthened by utilizing triangulation.

3.4.1 Interviews

Interviews were the prevalent method utilized in addressing the epistemology. Miller and Glassner argue that in-depth interviews offer the opportunity to gain information (Miller & Glassner 2004). The information relates to the experiences of interviewees that assist the social researcher in developing *"stories"* (Miller & Glassner 2004) p.138. These stories provide valid descriptions or explanations of a phenomenon – in this case innovation as it applies to the FFNHP segment in Canada. This approach is consistent with the rationale provided by Denzin and Washington (Denzin & Lincoln 2005).

This specific tool appears to be the method of choice in conducting social inquiry (Holstein & Gumbrium 2004). Fontana and Frey concur and contend that *"we are in the interview society where everyone gets interviewed"* (Fontana & Frey 2005) p.695.

The traditional or conventional form of interviewing places the interviewee in a passive position simply providing factual responses to simple questions. This format is the survey interview (Holstein & Gumbrium 2004). The conventional form is conducive to using in quantitative research as the responses are often easily measured.

The creative interview is another conventional format that requires the interviewer to share emotional feelings in order to bond with the interviewee with the goal of gaining access to the inner emotional sanctum of the interviewee (Holstein & Gumbrium 2004). Given the complexity and nature of innovation, neither of these types of interviews appeared appropriate.

The methods of interviewing have evolved into what is commonly expressed as being active. Active interviewing is based on the concept that interviews are a *"social encounter"* (Holstein & Gumbrium 2004) p.141. They involve participation by the interviewer not just in posing questions but developing concepts tapping into the experience of the interviewee to gain a better understanding of the phenomenon in question (Fontana & Frey 2005; Holstein & Gumbrium 2004; Miller & Glassner 2004). This method results in the development of *"experiential knowledge"* (Holstein & Gumbrium 2004) p.155.

A final form of interviewing was considered. Fontana and Frey identified a new emerging form of active interviewing – the emphatic approach. This format incorporates the active participation of the interviewer but moves the interviewer from a participant in inquiry to one of advocacy where he/she uses the results to improve the situation for the phenomenon being studied. The authors refer to this form of interviewing as the emphatic approach (Fontana & Frey 2005).

Active interviewing without the emphatic addition appeared to be the best alternative for gaining a better understanding of a concept that is not only complex but difficult to grasp. It should also be noted that active interviewing alone would not be the key to gaining in-depth knowledge. Active interviews could be conducted with any person with an interest in the area. The key however is to tap into the knowledge of people with experience and knowledge in the subject matter. These interviews are deemed to be elite interviews (Burnham et al. 2004).

The elite, active interview, social encounter approach addressing the epistemology therefore seemed appropriate due to the level of achievement that each interview target possessed. By targeting elite participants within the four spheres of the triple helix twins, the researcher was able to gain necessary data that provided the depth and insight required to investigate the topic.

To ensure a broad perspective, actors within each sphere of the triple helix twins were interviewed: industry, government, research/university and the public/civil society (as represented by non government organizations). Table 6 provides an overview of the interviews and the process. The following pages provide further explanation of each point in the table.

Table 6: Overview of interviews

Actors	Number of interviews	Type	Average interview length	Shortest interview	Longest interview
FFNHP sector	17	9 in-person 7 phone 1 Skype video	59 minutes	28 minutes	94 minutes
Canadian food sector	6	4 in-person 2 phone	65 minutes	50 minutes	68 minutes
Multinational food sector	2	2 phone	48 minutes	32 minutes	63 minutes
Retail	1	1 in-person	59 minutes		
Research	6	4 in-person 2 phone	74 minutes	61 minutes	87 minutes
Government (public service)	5	2 in-person 3 phone	49 minutes	29 minutes	67 minutes
Government (politician)	1	1 in-person	53 minutes		
Non Government Organization	2	1 in-person 1 Skype video	57 minutes	54 minutes	59 minutes
TOTAL	40	22 in-person 15 phone 2 Skype video	2,433 minutes or 40.55 hours of total interview time		

The criteria used for selection of the interviewees varied by actor sphere of the triple helix twins (industry, government, research, public). Depending on the actor group, a combination of criteria was utilized to select each interview target: firsthand experience of the sector; knowledge of the sector; knowledge of the concept of innovation; successful introduction of new products or technologies; representation of the science-based companies and inherently healthy companies; regional representation; size of the company (from small and medium sized enterprises to multinationals); various stages of the demand network; policy-makers; policy influencers; and recommendations by interview targets. With respect to the last point, company Presidents or very senior public servants were approached for participation in the research. It appeared that the larger the organization, the initial interview target recommended another person. In eight instances, the senior contact recommended another person in the organization who in their opinion was better versed in the area of innovation.

The researcher used three basic avenues to request participation in the research: contacting interview targets known to the researcher; cold call requests directly to interview targets not previously known to the researcher; utilization of the researcher's social network for introductions to difficult-to-reach interview targets.

In all instances, the interview targets were approached first by electronic mail (e-mail). The e-mail provided an introduction including two attachments: 1) the explanatory statement; and 2) the letter of introduction as required by the Ethics Committee of City University London. The letter and explanatory statement provided the following information: name and contact information of the researcher; the two advisors and the Secretary of the Ethics Committee for City University; the title and overview of the research; rationale for targeting that person; the expected benefits of the research; request for their participation; data protection and confidentiality strategy; access to thesis once complete; and the nature of questions that would be explored during the interview.

The e-mail explained that the researcher would be in contact shortly to answer any questions regarding the materials and request the interview. In all cases, the interview targets received a phone call three to five days later. Where necessary, a maximum of five requests were made to the potential interviewees: an e-mail introduction including the letter and explanatory statement; two follow-up phone calls; an additional e-mail; and a final phone message request. A total of forty-nine requests to various organizations for participation in the research resulted in forty interviews. This number does not include the eight interview targets that referred the researcher to other people in their organization.

All interviewees were asked to sign an Informed Consent Form. The form indicates the agreement to voluntarily participate in the research, noting confidentiality of information and data offered as well as stating that they could choose to withdraw their responses upon conclusion of the interview. It also identified the intention to record the interview to ensure that information would be properly interpreted.

Industry interviews

Seventeen interviews were conducted with representatives of private enterprises in the Canadian FFNHP sector. With respect to company representation, their selection was identified primarily on achievement which could be measured by a

combination of their position within the company; the length of time the company has been in business relative to the sector; the size of the company; recognition of their innovative activities by their peers.

FFNHP sector interviews resulted from requests to twenty organization representatives. In order to achieve a Canadian wide perspective on the research topic, the interviewees represented the various regions of the country: three interviewees from British Columbia; three representatives from Alberta; one representative from Saskatchewan; three representatives from Manitoba; one representative from the prairies representing a Canada wide sector initiative; two representatives from Ontario; two representatives from Quebec; one representative from New Brunswick; and one representative from Nova Scotia.

In addition, six interviews were conducted with company representatives in the domestic food manufacturing sector. This approach was taken to compare approaches to innovation between the FFNHP sector and the food sector in general. The food companies represented in the interview process for this research also span the country representing British Columbia, Ontario and Atlantic Canada. These companies are all Canadian based with international markets and in some instances, global operations and multiple business units. Representatives of three other Canadian food manufacturing companies were invited to participate but chose not to respond to the multiple requests.

Representatives from multinational enterprises (MNEs) were also approached. The researcher deemed it important to include this sector due to their presence in food manufacturing and marketing in Canada. Securing insight from this group proved to be very challenging. The researcher's social network provided assistance at identifying and providing initial contact with appropriate members of this actor group. Two interviews resulted from the five MNEs approached. Note that one of the two interviewees was a recent retiree of an MNE. Both interviewees were not as open as their Canadian counterparts. Neither one would respond to specific questions relating to his own company which they noted was against company policy. One other interview target agreed to participate on behalf of his company and subsequently declined participation just prior to the interview appointment. One other MNE interview target required approval from company lawyers who then prevented him from participating. Another MNE interview target stated that it was against company policy to participate in this type of research.

Further input regarding MNEs' approach to innovation was therefore accessed through information garnered at the 2007 annual conference and food exposition of the Institute of Food Technologists. IFT 2007 (the conference and food exposition) was held in Chicago on July 29th - 31st, 2007. The theme of the show was health and wellness. An 'Executives' Forum' was held as part of the conference. The theme of the forum was 'Cut the fat on industry's approach to health, wellness and foods'. Executives from General Mills, Kraft, Campbell Soup and Nestle presented their company's approach in the health and wellness sector as well as innovation. The notes taken of the executives' presentations were then compared to the interviews of the two representatives of MNEs interviewed as well as that of the large Canadian food companies. The interview results were consistent with the presentations made at IFT 2007 during the leaders' forum.

As well, it was apparent from the presentations that MNEs look to smaller companies as part of their innovation strategies. The presenters from Nestle and General Foods both referred to alliances with and investments in smaller companies to harvest innovations for the benefit of the MNE. That portion of their strategy therefore could be considered in the examination of the small companies.

A representative of one major Canadian food retailer was also interviewed for this research. In total, participation was requested of the five major retailers in Canada, resulting in one interview. The approach was made to the retailers to gain a broader perspective on the concept of innovation. This segment is driving consolidation and power in the food system and is also the vortex of the demand network. Their participation therefore was considered valuable.

The researcher approached the retailers using both formal and informal measures. The formal measures were those used to secure interviews from other stakeholder groups. The informal measures were used when the formal measures proved to be of no avail. They included in one instance attending at corporate offices and hand delivering the request for an interview. In another instance, a store manager where the researcher shopped was approached to request his assistance in securing input into the research from senior levels of his company. In the end, the researcher received no response to her request from two retailers and representatives of the other two retailers stated that it was against company policy to be interviewed for this type of research.

The participation of the major retailer was secured by utilizing a personal network.

Of the twenty-five Canadian for-profit FFNHP and food manufacturing companies represented in the interview process for this paper, six are identified in the recent 2008 Canadian Food Industry Report as among the top one hundred food and beverage processing and manufacturing companies in the country. Based on the listings of sales and value of the industry, these six companies alone represent twenty percent of the Canadian food manufacturing industry (Burn 2008).

Government interviews

Five federal public servants representing four different government departments were interviewed. The interviewees were approached on recommendation of their colleagues as the leading knowledge provider and/or policy developer in the area of innovation in their respective departments.

As well, one politician was interviewed regarding the triggers of public policy. A politician was not originally considered as an interview target. Several interviewees from both the private and public sector however suggested that policy triggers would be best answered from a political viewpoint. This point will be discussed further in Chapter 6. The politician interviewed has held a seat in Parliament for a number of years as well as a Cabinet position, bringing experience from both the opposition and government side of the House.

Public interviews

Representatives of two non government organizations (NGO) were interviewed and represent the actor sphere of the public/civil society. In the policy arena as depicted in Figure 9, p.56, NGOs are linked to the public and are therefore considered for this research as representatives of this sphere of the triple helix twins.

Some cross over with the government sphere is acknowledged due to the source of funding for operations of both NGOs in question. The NGO of one interviewee receives funding from both the federal and provincial governments to foster innovation and company growth in his province. The second interviewee represents an NGO focused on policy analysis on various issues.

Research/University interviews

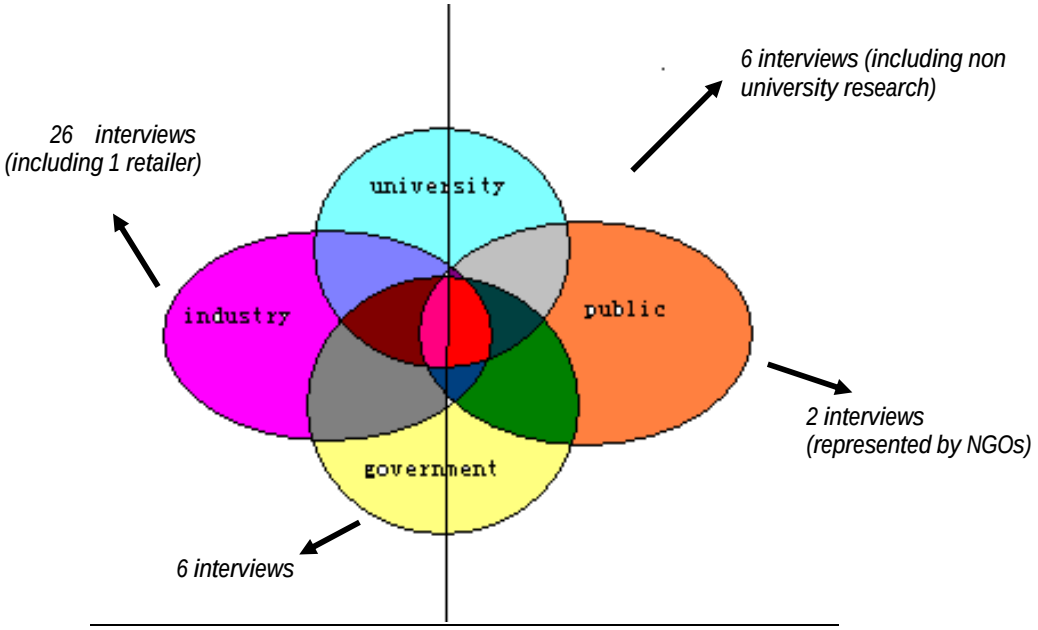
Six interviews were conducted with representatives of the research/university sphere of the triple helix. In order to gain a broad perspective, three academics, one scientist in a federal research institute and two representatives of applied research organizations were interviewed. The academics represent varying disciplines: nutritional sciences; business administration; and agricultural economics. Each academic is nationally and globally recognized for expertise in innovation and/or policy as it applies to their specific discipline.

The scientist has conducted research into bioactives focusing on health and wellness food ingredients for much of his career. His research has also resulted in several patents which were later licensed to industry.

The fourth and fifth interviewees represent the applied research component. The organization of one of these interviewees provides a link between basic research and industry. As such, his organization must find new approaches to solving technical problems for industry and scaling up the basic research of academics and other researchers. The FFNHP sector is a market segment that this organization serves. He offers a unique perspective therefore and was deemed to add value to the research. The second applied researcher works with an agency that works directly with companies to address both technical and market issues facing their clients.

In summary, the following figure provides an overview of the number of interviews with respect to the Triple Helix of innovation.

Figure 23: Interviewing the Triple Helix actors



The figure demonstrates support for actor theory in the primary research process due to the various roles taken by each of the actor groups in innovation, the Canadian food system and the policy arena in the country. The literature demonstrates that tension and conflict exists among the actors (Cohn 2005; Coleman et al. 2004; Friedmann & McMichael 1989; Naylor & Toope 2010) which then provided a suitable framework upon which to base primary research. The support for and use of actor theory therefore provided the rationale for the use of active, elite interviews allowing the interviewer to get into the minds of the interview targets.

3.4.2 Approach

Three approaches were taken in conducting the interviews: in-person interviews; telephone interviews; and video conferencing. The preferred method of interviewing was in-person. This method allowed the researcher to make eye contact, gauge body language and therefore best assess levels of comfort with and knowledge of each question. In total, twenty-two in-person interviews were conducted.

Thirty-five interviews were conducted over the period February to August 2008. Five interviews were conducted December 2008 to March 2009. The researcher made specific trips to various regions of the country to conduct the interviews at the interviewees' places of business: May 6-8, 2008 in Saskatchewan and Alberta; May

12-14, 2008 in Manitoba; June 15-20, 2008 in Ontario; August 27-28, 2008 in Saskatchewan; and February 10-12, 2009 in Ontario. Some in-person meetings that were arranged in the various destinations were cancelled by the interviewees at the last moment due to the busy schedules and priorities of the interviewees. In addition to those interviews that required re-scheduling to a phone interview, interviews east of Ontario were conducted by phone.

The rationale for conducting interviews using other methods than in-person is that Canada is a vast country. Due to its size, the length of time to travel to various regions (five hour plane ride between Vancouver, British Columbia and Toronto or Ottawa, Ontario) and the affiliated cost of travel, prohibited travel for re-scheduled interviews. For the same reasons, the researcher did not travel to destinations east of Ontario, home to a total of five interviewees.

As a result, sixteen phone interviews were conducted. Obviously, it was not possible to gauge body language or make eye contact with telephone interviewees. The researcher drew on her skill and experience in conducting phone interviews to ensure that responses derived utilizing this approach resulted in rich dialogue similar to that of the in-person interviews. As well, the researcher believed that interviews conducted by phone were somewhat more focused than those conducted in-person.

Finally, two interviews were conducted utilizing the computer video conferencing program Skype. Both interviewees were previously known to the researcher and therefore there was no discomfort on either side with the technology or in conducting the interview.

The following table provides a listing of the interviewees utilizing codification, their provinces with respect to industry and their positions. The province was identified only for industry. To protect confidentiality of the other actor groups, the province and official titles are not provided. As well, public servants' positions and departments are not provided, also to protect confidentiality. While the industry is large enough that titles and provinces would not betray those interviewees, interviewees in the other actor groups would be easily identifiable within the context of Canada.

Guaranteeing confidentiality to all stakeholders was deemed necessary to the successful implementation of the epistemology. As identified previously, the

objective of qualitiative research is to conduct an inquiry into a phenomenon that is not well understood. While identification of the interviewees would have been of interest to the reader and perhaps added to the credibility of their perceptions and arguments advanced, the fluidity and thus richness of the interviews could have been impeded. The result would then be a significantly condensed exploration of the phenomenon of innovation and less candid examination of the policy environment under study.

The FFNHP and food sectors are highly competitve and under stress given the economic times. As well, many industry actors have accessed government funding and will continue to do so in support of their research, development and marketing activities. As proven during the interview process, these actors demanded assurances that their names and companies would not be identified so as to protect their competitive position in the marketplace and any future government funding.

With respect to academic and NGO actor groups, the research indicates that both sectors rely on government funding for portions of their research and activitities. Any views regarding government policy therefore may have been guarded by this group, again detracting from the inquiry.

Government actors are not immune to concern regarding confidentiality. Accountability is one of the key pillars of the current federal government. The result has been, and proven during the interview process, that public servants are operating within an environment of fear. To ensure open dialogue during the interview process, confidentiality was also required for this actor group.

The listing demonstrates the depth of expertise and experience secured for this study. Note that the codes used are referred to in subsequent chapters allowing the reader to identify to which group the interviewee belongs. For example, all industry interviewees are provided a number but prefaced by “I” for industry. “R” signifies the retail representative. Likewise, government interviewees are identified with “G” prior to their number. “A” signifies the academic/research interviewees. And finally “NGO” represents the non government organizations / public / civil society actor group.

Table 7: List of interviewees

Interviewee Code	Province	Position
Functional food and natural health product industry actor group		
I-1	Saskatchewan	President – Functional food company
I-3	Manitoba	President – Functional food company
I-4	Alberta	Chair of the Board – Natural Health Product company
I-5	New Brunswick	President – Functional ingredient company
I-6	Manitoba	President – Functional food and natural health product company
I-7	Manitoba	Scientific and Human Health Officer – Canadian functional ingredient organization
I-8	Manitoba	President – Functional food company
I-9	Nova Scotia	Vice-President Research & Development – Natural health product company
I-12	Quebec	Vice-President and Chief Scientific Officer – Natural health product company
I-14	Quebec	Vice-President Research & Development – Functional ingredient company
I-15	British Columbia	President – Natural health product company
I-16	Alberta	President – Natural health product company
I-17	British Columbia	President – Functional food company
I-18	British Columbia	President – Functional ingredient company
I-19	Ontario	President – Natural health product company
1-20	Alberta	Vice-President – Scientific and Regulatory Affairs
I-23	Ontario	Vice-President New Product Development – Natural health product company
Food industry actor group		
I-2	Ontario	Director, Innovation and New Product Development – Large food company
I-10	British Columbia	President – Large food company
I-11	New Brunswick	Vice-President New Product Development – Large food company
I-13	British Columbia	Chief Operating Officer – small food company
I-21	Ontario	Vice-President Innovation – Large food company
I-22	Illinois	Director, New Product Development – Multi-national food company
I-24	Michigan	Retired Director, New Product Development – Multi-national food company
I-25	British Columbia	President – small food company
R-1	Ontario	Senior Vice-President Groceries – national retailer
Academic/research actor group		
A-1	A published Canadian academic in health and nutrition	
A-2	A published Canadian academic in agricultural innovation	
A-3	A published Canadian academic in innovation	
A-4	Researcher in private institution – Functional ingredients, natural health products	
A-5	Researcher in private institution – Functional ingredients, natural health products	
A-6	A published Canadian researcher in functional ingredients, natural health products	
Government actor group		
G-1	Federal government department A – Innovation policy	
G-2	Federal government department B – New product policy	
G-3	Federal government department C – Innovation policy	

G-4	Federal government department D – Innovation policy
G-5	Federal politician
G-6	Federal government department D – Commercialization specialist
Public / Civil Society actor group	
NGO-1	Executive Director – Organization devoted to assisting companies in food system innovation and commercialization
NGO-2	Director – Institute providing evidence and recommendations for policy

3.4.3 The interview guide

The following table provides an overview of the primary interview questions relating to each research question posed to the interviewees. As noted above, the active interviews did not follow the emphatic approach by building on the responses of each interviewee, as outlined by Fontana and Frey. Rather all questions were posed to each interviewee. The exception was the interview conducted with the politician who spoke only to policy triggers and development of policy.

Prior to beginning each interview, an explanation for the research was given to allow the interviewee time to transition from their work to process at hand. The goal was to put the interviewees in a frame of mind that was relaxed but thoughtful.

Table 7: Research questions

Research question	Interview question
R-1: How is innovation being defined and approached in two segments of Canada's food system: food manufacturing and functional food and natural health products?	IQ-1**: What is your view of what innovation is? How would you define it? What is unique about innovation in the FFNHP sector *[or food sector depending on the interviewee]* from other industries?** IQ-1A: **Would you describe the functional food and natural health product (FFNHP) *[or food sector]* in Canada as being innovative? Why / why not?**
R-2: What is driving innovation in these segments?	IQ-2: **What do you see as the major drivers of innovation and will they change in the future?** IQ-2A: **Is the FFNHP sector *[or food sector]* being forced to innovate? If so how and by whom?**
R-3: How is innovation measured?	IQ-3: **Does your organization have specific objectives regarding innovation? How would you describe your company's approach to innovation?** IQ-3A: **How do [would] you measure innovation in your organization? How do you know if innovation focus has been successful?** IQ-3B: **Do you see the measurements of innovation changing in the future? And if so, how?**
R-4: How has Canadian innovation public policy affected innovation in the food system and has the framework affected growth or restriction of small and medium sized enterprises (SME) in one or both the segments?	IQ-4: **Are you familiar with Canada's public policy on innovation in general? And also as it relates to the FFNHP or food sectors? How would you describe it?** IQ-4A: **How has that innovation public policy affected companies in the food system? And SMEs in the FFNHP segments in Canada?**
R-5: **What kind of policy framework would assist the growth of innovation in SMEs in Canada in the emerging FFNHP sector?**	IQ-5: **What public policies would assist your organization in being more innovative?** IQ-5A: **From your perspective, what are the triggers that would lead to the new policies you are suggesting? (i.e. what needs to happen to cause those changes?)**

The average length of time to conduct the interviews was one hour, one minute. The researcher was pleased with the time provided by the interviewees given their senior positions.

The length of time of each interview did not appear to be an indication of the level of knowledge or understanding of the subject by the interviewee. Therefore the length of interview did not correlate with the richness of the information gleaned. For

example, interviewee (I-16) affiliated with the FFNHP sector gave the shortest interview – twenty-eight minutes. This particular interviewee was well versed, focused and responded strongly to each question and thereby provided rich responses. One other interviewee (G-3) was almost as short. This time span was due to time constraints of the interviewee.

In all cases, interviewees spent the highest percentage of their time discussing and defining research question 1 - the concept of innovation. On average the researcher estimated that thirty-seven percent of interview time was spent discussing this area. The length of time spent exploring the definition was estimated as most interviewees discussed the concept throughout the interview. A few explanations or combination of explanations could be given for this matter. It could confirm the complexity of the phenomenon. It could be that their schedules and work pressures were such that it took time for the interviewees to focus on the topic. It could be that they had not reviewed the information and formulated their thoughts prior to the interview.

Note that six interviewees, five from industry and one from government (I-17, I-19, I-20, I-23, I-25 and G-6), actually thanked the researcher upon completion of the interview. They stated that it helped them articulate their own thoughts; formulate strategies; or focus discussions within their own organizations.

Interviewees spent on average seventeen percent of their time discussing research question 2, focusing on the drivers of innovation. Research question 3, examining measures of innovation in the sector ranked only slightly higher, averaging eighteen percent of interviewee time. Interviewees spent on average only eight per cent of interview time discussing Canada's public policy on innovation – research question 4. This figure was somewhat skewed by the lengthier responses of the government respondents. And finally, interviewees spent on average twenty per cent of the time discussing research question 5, assistance to foster or enable innovation.

3.4.4 Conducting the interviews

Miller and Glassner offer a word of caution in active interviewing. Due to the nature of active interviewing where new ideas are jointly formed and/or explored, the interviewer must insert some limitations in order to report the findings in an efficient manner. These limitations open the research to accusations of being incomplete (Miller & Glassner 2004).

In-depth discussions of the findings with advisors and examination by the review committee (including an external examiner) were expected to assist in mitigating that risk. In addition, it is questionable whether research is ever complete. While objectives may be met, research usually identifies gaps and areas that require further examination.

An additional concern of opponents of the active interviewing process is bias. The inclusion of the interviewer in the development of concepts in the active interview opens this format to accusations of bias in the research. Holstein and Gumbrium argue that the active interviewer can ward against bias by focusing on how the questions will be asked (Holstein & Gumbrium 2004). All interviewees for this research, except the politician as identified previously, were asked the same questions, using the same wording and in the same order.

An additional method to ensure transparency of the process and reduce the concern of bias is through audio taping of interviews. Silverman argues that audio tapes offer public record of the research. Audio tapes also allow for focus on the details of the interview rather than the interpretation of the details that would result if using only field notes – and thus the possibility of bias (Silverman 2004).

Thirty-five of the forty interviews were recorded for reference purposes where recording was agreed to with the interviewee. Taping was done utilizing an iTalk (recording device) attachment on the researcher's iPod. Recorded interviews were then downloaded to the researcher's computer.

A request to record was not made to one interviewee due to his apparent extreme concern about the use of his responses that could potentially be used by his competitors. Three interviewees requested that their responses not be recorded also out of concern about the future use of the recordings. While each of the three interviewees was assured of confidentiality, their responses were not recorded in deference to their wishes. One interview was accidently deleted. In all five cases, expanded notes of the discussions were made immediately following the interview to ensure that all points were captured.

Copious notes were taken during each interview. Expanded notes of each interview were then written within a couple of days of the actual interview utilizing Microsoft computer programs Word and Excel where appropriate. Both programs are

searchable and compatible with EndNote, the software program used for managing bibliographies. The recordings were used for reference and clarification of points in the written notes.

Comment must be made at this point on Silverman's position on tape recordings representing public record of the research thereby mitigating bias on the part of the research (Silverman 2004). While recordings were made, they do not represent public record of this research. Confidentiality and protection of information was guaranteed to all interviewees both in writing as well as verbally. Given the competitive nature of the industry, the relationships among the interviewees and the position within the organizations of the interviewees, the use of the recording device would not have been possible without that guarantee.

As a method to enforce the confidentiality, all primary data gathered as a result of the interviews (audio tapes, written notes, computer files from the interviews) will be destroyed immediately following acceptance of the thesis.

3.4.5 Analysis of the interviews

The risk of including previous knowledge regarding the industry and government was acknowledged. To ward against the risk and ensure that the data collected for the research was the foundation of analysis, three approaches were utilized: 1) use of software; 2) review of all audio tapes prior to analysis and upon completion of the initial draft written analysis; and 3) continual referral to all responses when making generalizations.

Creswell and Maietta recommend the use of software for a systematic approach of analysis of data collected. The software allows for ease in searching when a defined group of search words are utilized so that no relevant data is missed (Creswell & Maietta 2002). The primary software tool utilized for analysis for this research was Microsoft Word. Its searching capability is user friendly and ensured that all written documentation could be easily categorized and searched.

Although written notes of each interview were the primary reference tool, the audio tapes proved invaluable. Prior to analysis of the data, all recordings were reviewed and compared to the written notes of the interviews. Perakyla points out that a review of recordings increases the understanding of the contextual nature of the responses to ensure that transcripts, or in this instance, written notes of the

interviews, capture the essence and richness of the responses (Perakyla 2005). Upon completion of the analysis the recordings were reviewed again.

Finally, the written notes were reviewed on a continual basis. Silverman argues that in qualitative research, continual referral to the data sets guards against generalizations made that may in fact pertain to fewer than all sets (Silverman 2004). In this instance, the notes were reviewed continually.

As well, triangulation was used to strengthen the analysis of the results. The findings of the primary research were triangulated with that of the academic literature as well as the social or grey literature.

3.5 Conclusion

This chapter provided an overview of the research pathway for the study that includes the framework, the research design or strategy, the rationale for choosing the strategy and a description of the implementation plan.

The framework for research to investigate the policy environment that enables innovation is founded in academic and social or grey literature. The framework provides focus for the study and the rationale for its focus. In this instance, the investigation focused on the functional food and natural health product sector of Canada. Innovation is complex and not well understood, particularly in this segment of the economy.

Based on the framework, the chapter argues that qualitative research was the best method for exploring a concept that is complex and not well understood utilizing elite, active interviews. Quantitative methods were considered but discounted due to the nature of topic.

Forty interview targets were also described demonstrating the knowledge and experience each one possessed while protecting confidentiality. These interviewees represent a sample within the triple helix of innovation.

The chapter also outlined the five research questions and the interview questions that address the research questions. The following chapters provide the findings of the interviews based on the research questions and the affiliated interview guide. Chapter 7 then triangulates the findings with the literature (academic and grey).

Finally, the chapter addresses confidentiality. Several of the interviewees, while recognized by reputation, colleagues, market success or position for their knowledge and expertise in the area of innovation and/or policy, expressed extreme concern regarding a reader's ability to link opinions or views to the interviewee. Necessary measures to protect the identity of the interviewees were therefore described.

CHAPTER FOUR – Interviewee perceptions: The concept of innovation and the food system

"We've been involved for decades in focusing on innovation – in fits and spurts. We're doing something wrong and I don't know what it is".
A-1 (a leading Canadian health and nutrition academic and researcher)

4.0 INTRODUCTION

Chapter Four is the first of four chapters that presents and analyzes the findings of the field work. It focuses on the concept of innovation from the perspective of thirty-nine interviewees representing the triple helix twins.

This chapter outlines four core arguments. The first argument is that the concept of innovation is multi-dimensional. In other words, it encompasses more than one concise meaning and varies even within actor groups. In most instances, gaining economic value was a critical theme. The concept however included the dimensions of tangible and intangible outcomes, discovery, process, systems and characteristics including human characteristics (e.g. mindset).

The second core argument is that Canada's FFNHP sector is not innovative but that innovation does exist in some companies. As well, there appears to be a blurring of the lines between the food sector and FFNHP sector. With the movement toward health in the food sector, the degree of innovation may be the differentiating factor. The food sector needs to protect its brands therefore focuses on incremental innovation. Any more radical innovation occurs within the enabling industries such as equipment or packaging.

The third core argument is that differences exist in innovation in the food and FFNHP sector to that of other industries. Food and nutrition is deemed to be sacred resulting from an emotional, cultural and religious attachment to food not seen in other industries. There is also a risk to do harm through consumption of food and nutritional products resulting in a regulatory environment that is deemed to be a drag on innovation.

Finally, this chapter argues that tensions exist within and among the actor groups. The tensions are a result of no common understanding of innovation as well as challenges faced which are deemed to be drags on innovation. These challenges

include the regulatory environment, lack of collaboration, lack of scientific capacity in the sector and a public and private culture in Canada that is risk averse.

4.1 The definition of innovation

"The use of the term innovation is overused and really doesn't mean much anymore".
Interviewee A-2

Interviewees spent the highest percentage of their time discussing the concept of innovation. In all but five interviews (three industry – one FFNHP company [I-16] and two large food companies [I-2, I-21]; and two government [G-3, G4]), the interviewees developed their concept of innovation over the period of the interview. In other words, the interviewees for the most part struggled with clearly articulating their own concept of innovation. They continued to develop their concept even when discussing other research questions.

One interviewee (I-20) was open enough to state, *"it's* [innovation] *not something I spend a lot of time thinking about"*. The interesting point is that this particular interviewee is a senior executive in an NHP company cited most often in the field work as one of the most innovative companies in the country. It demonstrates that the concept of innovation itself is not really the focus for these companies. The conclusion may be that innovation is simply innate and that these companies just do it.

Sections 4.1.1 to 4.1.5 describe the discussions by actor groups on the concept of innovation. The actor groups reflect Etzkowitz's Triple Helix Twins of innovation: industry – exemplified in this instance by the FFNHP, food manufacturing and retail sectors; research; government; and the public – represented in this instance by the non government organizations.

It is also important to note that the discussion with the one representative of the food retail sector is added to that of the eight food sector representatives. To guarantee confidentiality, the researcher deemed it necessary to combine the discussions of the retailer with another actor group. Combining the discussions of these two actor groups seemed the most rational for the following reasons: both groups seek to reap financial benefit from innovation; the retailer is producing and contracting private label products and; five of the eight food manufacturers are identified within the top 100 food companies in Canada of 2007 (Burn 2010).

4.1.1 Definition - actor group: industry - functional food and natural health product sector

The following discussion reflects interviews with senior representatives of seventeen FFNHP companies across Canada.

The concept of innovation as described by this segment of the industry actor group could be captured in four general categories: 1) outcomes – physical and intangible that produce value for the company; 2) discovery; 3) characteristics – outcome and innovator; and 4) process. In all instances, the categories focused on positively impacting the profit levels of the company.

Table 8 below provides an overview of the key concepts of innovation as presented by the seventeen functional food and natural health product interviewees.

Table 8: FFNHP interviewees' concepts of innovation

Concept of Innovation	Primary Focus	Goal
Outcome (I-1,I-3,I-4,I-6,I-9,I-14,I-16, I-18,I-19,I-20)	New: • Product • Service • Technology • Process	Provide value: • Economic
Outcome (I-1,I-4,I-5,I-7,I-8,I-9,I-14,I-15, I-16,I-17,I-19,I-20,I-23)	Value: • Shareholder value • Branding strategy • Business models • Buyer value	Provide value: • Economic
Discovery (I-6, I-8, I-12, I-18, I-20, I-23)	Create new knowledge	Apply knowledge to create economic value
Characteristics (I-1, I-3, I-4,I-5, I-6,I-7,I-8,I-9, I-12,I-14,I-15, I-16, I-17, I-18, I-19, I-20, I-23)	New, market-driven, patentable, timely, transformative or incremental, academic or commercial: • Product • Service • Technology • Process Human element: • Action-oriented • Committed attitude • Risk taker • Open to new ideas • Foresight capability • Lucky	Provide value: • Economic • New knowledge
Process (I-3, I-6, I-9, I-12, I-20, I-23)	Commercialization • Implementation of an idea • Market acceptance	Provide value: • Economic

Note that the categories discussed were not generally mutually exclusive and opinions usually encapsulated at least three of the categories. Any viewpoints that were limited to various categories however are identified.

Outcomes

Ten FFNHP interviewees (I-1, I-3, I-4, I-6, I-9, I-14, I-16, I-18, I-19, I-20) clearly stated that innovation equates to a physical outcome. The qualifier for the physical outcome is "new" and will be discussed below under characteristics.

The physical outcome can be expressed as a technology that will be used to make products. Two interviewees (I-4, I-18) discussed this focus on technological outcomes. From their perspective, the technology can then be applied to developing multiple products or reducing production costs. In their view, the technology represents transformational innovation while the consumer-ready products represent incremental innovation. The descriptors of transformational and incremental will be discussed further under characteristics below.

Two examples were given surrounding technology. The first was the iPod. This example is not surprising given that the researcher used an iPod with an iTalk attachment to record the interviews and therefore was clearly visible to the interviewees. While six interviewees (I-3, I-6, I-7, I-18, I-19, I-20) identified the iPod, the product, as an innovation, two interviewees (I-17, I-18) discussed the innovation connected to the iPod from the perspective of the technology which then resulted in a number of products.

I-17 explained that *"innovation is about making things easier … the technology behind the iPod is innovative. The innovative technology of the iPod made it easier for consumers to get music and listen to it when they want to … So innovation can be about reinventing the wheel – finding a better way of achieving the same goal and in this case with the use of technology".*

A second example of technology was given by I-4 as the focus rather than the consumer-ready products. He explained that the innovation was the development of a technology that allows for a standardized natural health product. This technology can then be used to make numerous products that ensure each dosage (e.g. pill or capsule) contains at least a minimum standard amount of bioactive ingredient. He expressed the view that *"the innovation is the platform technology, a technology that*

had never been done before, that is applied to develop the products … It's critical to be able to adapt innovations into multiple uses".

The reflections in this area inevitably turned to a discussion of when innovation actually occurs. Can innovation be both an idea or discovery and an outcome of exploiting that idea or discovery?

Nine interviewees (I-1, I-3, I-4, I-6, I-9, I-14, I-16, I-19, I-20) however focused their discussion on the physical outcome to products that are commercially viable resulting from the exploitation of the idea or discovery. While most of them discussed the key initiator of an innovation being an idea or discovery, their view is that the innovation is the product that applies the idea or discovery and only occurs when the company realizes revenue from sales of the product. One interviewee, I-16, expressed the point by arguing that *"innovation occurs only when a product is marketed. Discovery, proof of concept or scale-up are not innovation. Innovation occurs along that continuum but is an innovation only once a discovery is commercialized – it must provide commercializable value".*

I-17 agreed with the observation stating that *"it isn't an innovation until the discovery is adapted and made useful … and timing is critical in innovation. Innovation requires action and the window of opportunity in business is often small – you need to be able to move quickly".*

And two interviewees (I-3, I-17) stated that the product is no longer considered an innovation when sales and production processes have become routine OR competitors enter the market with "me-too" products. I-17 argued that *"once an innovation attracts competition or me-too product introductions, then it becomes a commodity and not an innovation".*

Four interviewees took the concept further, two (I-1, I-7) discussing the concept of the timing of the introduction of the product in the marketplace and two (I-1, I-19) discussing where innovation occurs.

While a product may be ready for the market, I-1 and I-7 noted that it can only be considered innovation if it brings value to the company. I-1 argued that "*innovation doesn't happen unless somebody buys something. Therefore it's very economic driven. Innovation must be able to contribute to the country's GDP or it cannot be*

considered an innovation". His definition may discount innovation in the social context.

I-7 took a different approach but agreed that something must bring value to be considered an innovation. She provided an example where the market was not ready for a product. I-7 discussed the development of a high oleic sunflower in the early 1990s that produces cooking oils featuring high monounsaturated, low saturates and a stable alternative to hydrogenated oils. She explained that *"the company developed a high oleic sunflower but the market wasn't ready for it. The company went bankrupt. But in 2002, the market was ready … It really wasn't an innovation until the market picked it up. The issue is that an innovation may not address a consumer issue at the time and therefore should not be considered an innovation but a failure – SMEs just can't afford to wait it out".* She went on to note that not only did consumers recognize the health benefits of the new oil by 2002 but also *"government regulations began focusing on phasing out trans fatty acids … the new breed of sunflower and the cooking oils it produced led to successful uptake in the market"*. From the perspective of the interviewee, the product was not considered an innovation until it was commercially viable. She also reiterated the positive effect government regulations had on the uptake of the new oil.

Two interviewees (I-1, I-19) back their claim of an outcome focused concept of innovation by stating that innovation can only occur within companies that are within a profit oriented environment. Research institutions including universities are not profit centered. Their view is that any research that occurs in these institutions must be applied by industry and can only be considered an innovation if it generates sales. I-1 for example explained: *"innovation needs to happen at the company level. 'R&D' through universities is so long term that innovation doesn't happen there. Universities don't have the will or the capacity to do it".*

Interestingly, I-18 stated forcefully at the outset of the interview that innovation equates to new products, later stated that *"the biggest innovation in Canada happens at universities due to the concentration of 'R&D' personnel".* When asked to explain this further, he noted that several products and technologies are developed at universities but commercialized outside of those institutions. He further stated that "*transformative innovation occurs in universities and incremental innovation, improvements on the transformative innovation, occurs at the company level".*

In summary, commercialization, selling of products and services was a key theme. I-19 summarized the thoughts of many interviewees by stating, *"research for research sake does not result in innovation. It must be taken to the market in order to be considered an innovation. If it starts at a university and just stays there, then it isn't an innovation".*

While the interviewees above focused on innovation as a profit generating outcome, I-12 noted that the outcome could be a different way of doing a process. She cited an example of research resulting in a 'new' (to be discussed below) therapeutic approach to treating a certain form of cancer. The innovation in her view was not the research but rather the outcome – in this instance a therapy. She argued that *"innovation could be a way for something to work that no has done before … Breast cancer before had been treated using an invasive technique with no therapeutic benefit … found a way of treating breast cancer using a staged technique that hadn't been done before. Health Canada at the time wouldn't allow it because they didn't believe the approach would work … But the research actually led to an innovative staged therapeutic approach – truly innovative because no one had done it before".*

Innovation was also identified in the form of intangible outcomes that result in economic or shareholder value for the company. In total thirteen of the seventeen FFNHP interviewees described innovation in terms of value.

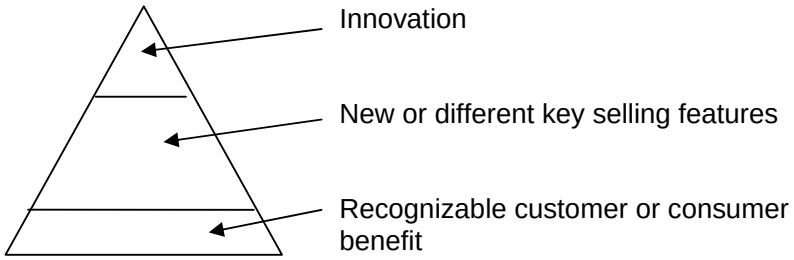
Examples of other forms of intangible outcomes given for this form of outcome were branding strategies and business models. The qualifying nature of these examples is however that they bring value back to the company. I-14 argued that the application of the pharmaceutical business model to the natural health product sector was an innovation because it had not been used in that sector previously. I-4 supported this view and noted that *"innovation is the application of the pharma model to NHPs … Innovation is changing the business model. It's about forgetting the model producing a commodity. It's about applying a business model that creates value for the shareholders".* While this example may fall under the category of characteristics in that it is a 'new' application, the example was provided by the interviewee to explain his point about the creation of shareholder value.

One might argue that the creation of shareholder value is a measure of innovation. The perspective of two interviewees, I-4 and I-14, however is that innovation and

shareholder value are indistinguishable. As I-4 stated, *"innovation IS* [emphasis of the speaker] *the creation of shareholder value".*

Value was also expressed from the viewpoint of the buyer or consumer. I-1 stated that *"a product or service can only be considered an innovation if it offers new or different key selling features that provide a recognizable customer or consumer benefit".* He drew the following diagram to explain his point. He referred to it as a *"product development pyramid".* He emphasized that "*if the consumer did not realize or more importantly did not recognize a benefit, then the product could not be considered an innovation"*.

Figure 24: Product development pyramid



While this point may be better positioned under the discussion of measures of innovation, it is important not to lose the interviewee's point. In this section, the discussion focuses on the definition or concept of innovation. I-1 interpreted his diagram to illustrate his point that *"innovation is in the eyes of the consumer"* or the buyer. He emphatically argued that *"the product or service could be new or offer different selling features, but if the consumer does not recognize it as a benefit, it's not an innovation"*.

The pyramid noted in Figure 24 will be applied in the discussion in Section 5.2.1 regarding innovativeness in the Canadian FFNHP sector.

Discovery

Six FFNHP company interviewees (I-6, I-8, I-12, I-18, I-20, I-23) challenged the perspective that innovation equates only to new products. While they concurred that

commercially viable applications are the goal, they believe that innovation also equates to discovery. In all instances, the interviewees discussed discovery in the context of research and development. The discovery could be deliberate or an unintended consequence of research activities. An unintended consequence resulting in a positive outcome was equated to serendipity. Also noted by this group was that the innovation/discovery does not necessarily result in commercial value.

I-6 argued that deliberate innovation occurs. In the example, she also identified a serendipitous aspect to the innovation by describing an example of a scientist in her company deliberately and successfully combining substances from two sources, a combination that had never been achieved to that point. Not realizing the commercial value of an application of the discovery, the results remained *"on the shelf"* for a period of three years before the company realized the value of the discovery and then commercialized it. From this example, she argued that "i*nnovation can happen at discovery even if you don't know what the application is at the time and it isn't applied until four or ten years later. In other words, it's innovation because you have deliberately set out to do something* [combine two substances] *but it's also an innovation because you've found a solution to something even if you don't know it. Innovation does not have to be commercially useful. It may be shelved to find a new home later".*

I-8 also provided an example of an unintended consequence which he considered *"great luck"* (or serendipitous) of a deliberate discovery. His company set out with the objective of conducting research into improving the health of animals entering the food supply system. Approximately two years after conducting the research, the company realized that not only did the health of the animal improve but the unintended consequence was that the meat and poultry offered a health benefit. He explained that *"the tipping point, the next discovery was made when we realized that it would provide human health benefit as well … We started out with the vision to do something about livestock health and we did it but now our primary focus is delivering the human health benefit".*

I-12 argued as well that innovation must be considered at the time of discovery. She stated that "*innovation could be the discovery of a new molecule. Innovation happens at discovery. There are lots of good discoveries just sitting on the shelf but because of wrong politics, bad luck, bad timing, or lack of money or they may not*

even be cost effective – they just didn't take. But just because they aren't applied or introduced, doesn't mean they are not innovations".

Interestingly, the examples cited throughout the previous section – the high oleic sunflower, meat providing a human health benefit and a combined substance – all are similar. The difference is when something is considered an innovation, either at discovery or when introduced successfully into the market. The majority of the FFNHP interviewees argue it is the latter case.

Characteristics

During the search to define innovation, many interviewees described it in terms of characteristics affiliated with either the outcome or the innovator. With respect to the outcome, characteristics identified were: new, unique, novel; market-driven; patentable; transformative; incremental; academic; and commercial. With respect to the innovator, characteristics identified were: action oriented; commitment; attitude; risk taker; openness; foresight; thinking differently; and lucky.

Twelve FFNHP interviewees (I-1, I-3, I-5, I-7, I-9, I-14, I-16, I-17, I-18, I-19, I-20, I-23) identifying innovation as an outcome qualified it by characterizing that outcome as being *"new", "unique",* or *"novel".* The words were used synonymously by that group. This aspect was applied to products, services and *"ways of doing things that result in value for the company"* (I-16). Four interviewees (I-12, I-18, I-20, I-23) who argued that innovation happens at discovery also used the terms *"new"* or *"unique".* An additional two interviewees (I-6, I-8) equated innovation with discovery. In that context, one can assume that "new" is implied. Therefore, fifteen of seventeen FFNHP interviewees identified innovation with something that has not been done before.

The expression of newness was captured by I-6 as *"something no one else has done to capture a new market. It's a new product or new way*". I-9 also commented by stating *"from a commercial perspective, innovation is an endpoint – it offers a point of difference from the competition. And novelty - it must have a novelty to it".* I-19 offered that *"innovation must be unique".* And I-12 stated that *"innovation could be anything that is a way for something to work that no one has done before. It must be unique – never before accomplished".*

With respect to discovery, I-3 described newness as *"discovery that no one else understood before or had not been tried before … Innovation is about doing something that somebody is not doing. It's a new concept … It could have been just too difficult to do before ... because we just didn't have the technology that would get us there".* He continued by stating that with the advent of new technology, new discoveries will happen at an increasing rate. Applying it to the FFNHP sector, he argued that new technologies will result in many discoveries that prove the efficacy of bioactive ingredients – in other words, proving that natural health products and functional ingredients provide a human health benefit.

Another interviewee, I-20, spoke of new in terms of a market. She provided the example of *"newness"* being the creation of entirely new markets: *"we didn't take market share away from the current suppliers. We expanded the market. We carved out new consumers, consumers that didn't want treatment but prevention. That hadn't been done before".*

New was also identified in terms of new uses or applications. This includes not only using a proven model in a new sector but also new uses for an old product. I-20 noted that this is particularly true for this sector. She argued that natural health products and functional ingredients are founded in traditional Chinese and aboriginal medicine. She noted that the newness or uniqueness is *"more about fine tuning traditional knowledge … and ensuring that the health promoting properties are guaranteed to be present in the product because if it is given as a whole, there are too many variables that can happen* [that will decrease the amount and effectiveness of the health promoting property] *like too much rain, too little rain, poor soil conditions, etc. … So innovation in NHP is adding value to traditional knowledge and taking away the uncertainty. Innovation is also about providing different delivery formats – the way it's delivered. The innovation is bringing ancient knowledge to western medicine – a market that has not used it previously".*

Interviewees also identified the innovation characteristic of being market-driven. Five interviewees (I-1, I-5, I-7, I-14, I-17) argued that an innovation must be market-driven. I-7 explained that *"innovation is about being a solution provider. It's about quality and efficacy – in other words, the innovation has to provide a solution that works – it has to solve a consumer problem and it has to work".*

Rather than approaching the concept of market-driven from the perspective of the company, I-5 approached it from the perspective of a consumer. He argued that *"innovation helps us to achieve the basic needs in life more efficiently and effectively. We all have four needs in life. Traditionally we think of them as food, shelter and clothing. But another one has been added. And that is entertainment – it has become a fundamental need in today's western society. Our lives have become so busy that we need innovation to help us meet our needs"*.

A third characteristic identified is patentability of an innovation. Four interviewees (I-6, I-9, I-12, I-18) described the need for an innovation to be patentable. I-6 noted that innovation *"involves some form of IP and must be patentable and not necessarily by the company. The company could follow some other form of IP* [intellectual property] *but for it to be an innovation – it MUST* [her emphasis] *be patentable".* I-9 and I-12 concurred with the patentability but not necessarily that the innovation be patented.

I-18 however argued that *"innovation is about patents. If you can't patent it, then it isn't an innovation".* When pressed for clarification, this interviewee clearly believes that it must be patented, and that the patent is actually a measure of whether it is an innovation.

Three (I-6, I-9, 1-12) of the four however were more inclusive by noting an innovation must have intellectual property rights (IPR) attached which included patents. The two who added IPR explained that it could include patents, trade secrets or trademarks. The primary focus however was not just patents but also trade secrets. They discussed the need in the FFNHP sector of the critical importance of formulations and processes which in turn are classified as trade secrets. I-12 supported her notion by stating that *"innovations do not have to be patented and in many cases it's a mistake to patent discovery. Patent rules have too many loop holes"*.

The fourth differentiating characteristic of innovation discussed by six FFNHP interviewees (I-1, I-3, I-4, 1-6, I-14, I-18) was transformative and/or incremental innovation. Additionally I-6 raised the point but stated that incremental innovation does not exist. She argued that *"innovation must transform an industry or it's not innovation. It's either an innovation or it's not".* She provided an example of a crop that had been used traditionally for industrial uses. Based on certain discoveries

proving human health benefits of the crop, *"they completely transformed the industry affiliated with that crop providing new markets, higher value markets and increased plantings for the farming community"*.

The six interviewees identified above argued that there is both transformative innovation and incremental innovation. I-4 explained that *"innovation is the platform technology that is applied to develop products. Therefore the technology is considered to be transformative and the products are incremental".* He made the point that it is critical to be able to adapt transformative innovations into multiple uses in order to extract value that will attract shareholders.

The remaining interviewees concurred expressing the view that transformative innovation must occur first. I-5 explained the position by stating that *"incremental innovation tweaks the transformative innovation and makes the product better … a change or variation of the transformative technology".* I-18 concurred noting that "*transformative innovation usually happens first and then incremental innovation is a change or variation of the technology"*. He gave the example of the phone. "*The first phone was transformative. But the mobile phone was incremental.*

I-1 also provided the example of an incremental innovation. He discussed Tide ® Detergent. *"Just how many times do you have to reinvent Tide but there are still changes that consumers believe they need and are willing to buy? But those* [the changes] *are incremental".*

Another example of transformative innovation was the use of agricultural and forest plant materials that have traditionally been used for food are now finding industrial usage such as bioplastics, biocomposites, biofuels and other materials that allow for biodegradable products. In I-3's viewpoint, these innovations are transformative because they are transforming not only how and what is produced but also they are transforming consumer behaviour. The latter point was demonstrated by the uptake of usage of not only reusable bags for groceries, but biodegradable bags as well.

Two interviewees (I-3, I-6) noted that to be transformational, an innovation must not only transform an industry or a way of doing things or change consumer behaviour, it must also be *"bold, different"* (I-6). I-3 was more emphatic by stating that innovation *"has to have that wow effect … it has to take your breath away. It's something that is revolutionary".* He referred to iPod as providing the 'wow' effect.

Another characteristic noted by one interviewee was the distinction between two types of innovation: first, academic or research innovation and second, commercial innovation. I-9 has a doctoral degree and is the Vice-President of one of Canada's leading FFNHP companies. He noted that the two categories (academic/research and commercial innovation) are distinct and that the term innovation in itself should not be used. In the first instance, innovation is research driven and can happen without commercial applications. This view supports interviewees arguing that innovation is affiliated with discovery.

I-9 continued by expressing the view that from a commercial perspective, *"innovation is an endpoint … it offers a point of difference from the competition. It could be a brand, a process, for example that reduces costs, or a new product or ingredient. And from a commercial perspective, innovation usually is comprised of some form of IPR".* He argued that too often there is friction between the research community and commercial entities concerning innovation and that both actor groups play a part. He argues therefore that innovation must be referred to with the qualifying descriptor of either being academic or research innovation, or commercial innovation.

Also under the category of characteristics were personalized descriptors, in other words, descriptors of the innovators themselves. Seven interviewees (I-3, I-4, I-8, I-12, I-15, I-17, I-18) discussed the attributes of the innovators as part of a definition of innovation. These interviewees spoke of innovation in the form of a mindset. In other words, innovation is personal.

Innovation therefore was identified as *"entrepreneurial attitude and so only happens in SMEs"* (I-3). *"Innovation is risk-taking … Innovation is being free to look at new things and it's freedom to fail"* (I-12). *"Innovation is openness … it's about an open brain"* (I-18). *"Innovation is having foresight capabilities … seeing opportunities … Innovation is creativity. It's envisioning what could be, what the future could be and how I can be part of it"* (I-17). *A*n example was given of the latter comment. I-17 gave the example of Wayne Gretzky, arguably one of the best hockey players who ever played the game and *"his ability to look not where the puck is but where the puck is going to be".*

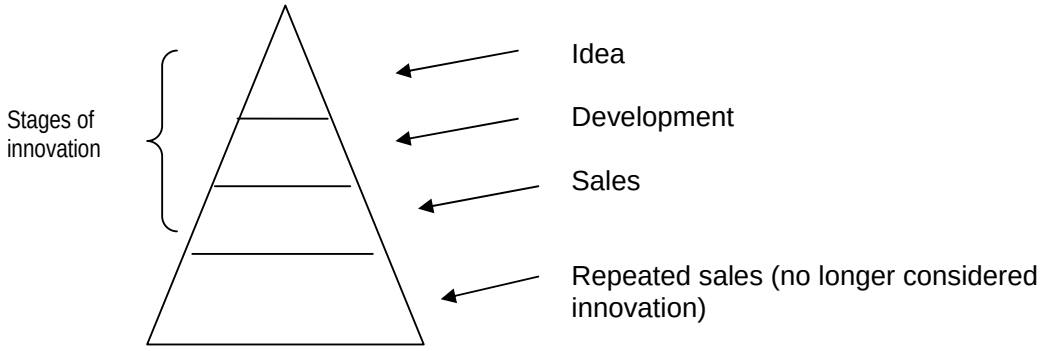
Foresight came into another example where I-8 claimed to have identified a specific market opportunity eight years before others and so was able to gain a competitive advantage in the market.

I-5 noted that innovation is part of *"the innovator's personal belief system"*. He continued that *"innovation has to have the fun factor to it"*. I-17 concurred arguing that *"innovation is having fun".* From their perspective innovation must have an element of significant enjoyment for the innovator.

Process

Finally, innovation was expressed in terms of a process. Six FFNHP interviewees (I-3, I-6, I-9, I-12, I-20, I-23) identified innovation as a process. I-3 illustrated his point concerning innovation as a process. His diagram follows:

Figure 25: The process of innovation



He expressed the view that an innovation "*begins as an idea, continues in the developmental stage of the product or service that is then marketed where sales occur".* Each of the three stages are intertwined and "*no stage is more important than the other. And innovation doesn't stop until the sales and production processes have become routine or competitors enter the fray with me-too products".*

I-3 and I-12 offered that the *"idea"* does not need to originate within the company or with the innovator. The idea could be *"inherited"* (I-3), *"purchased, licensed or*

adapted" (I-12). They continued by stating that if an idea did not originate within a company or the innovator, then it would be more difficult to make it personal (as defined above) and therefore more difficult to participate in the development. They were both strong proponents of the 'personal' characteristic of innovation. I-3 provided the example of being appointed the President of his company. His predecessor *"began the innovation process and then I was put in the position of developing it. It wasn't a good situation, but I continued because it was consistent with the vision of the company".*

4.1.2 Definition - actor group: food sector

The following information represents the discussion on the concept of innovation as perceived by eight representatives of the food sector and one retail actor. As noted in Chapter Three, six interviews were conducted with senior executives in the domestic (Canadian) food manufacturing sector and one representative of multi-national enterprises (MNEs) and one recently retired representative of an MNE. The Canadian companies market internationally and in some instances have international operations and multiple business units.

The food sector and retail representatives (hereinafter referred to as the food sector representatives or interviewees) in general were more succinct in their discussion regarding the concept of innovation. While the interviewees in both the FFNHP and food sectors developed their concepts over the course of the interview, five (I-2, I-11, I-13, I-25, R-1) of nine food sector interviewees stated at the outset that the term innovation is itself a challenge. Four interviewees argued that the word innovation is overused. R-1 explained that *"innovation is a lot like strategy. It's a buzz word".* And I-11 concurred noting that *"unfortunately, innovation is too much of a buzz word these days. Innovation is a problem of language. Everyone talks about innovation but everyone means something different".*

I-2 observed that *"the definition of innovation is everything from soup to nuts. Everyone has differing opinions of the concept of innovation ... the reason innovation is difficult to describe is that it's tough to define the BUTs and ANDs of innovation. It's very complex. If somebody came to me and asked whether we could do a* [gave the example of a product] *and we have a core competency* [in that product area]*, we would say yes BUT we won't do it. It is a totally new transformational process AND we would need to develop it."* In other words, I-2 argued that people lack the

appreciation of where innovation must occur. In this example, it is not the end product but rather the actual platform technology.

Table 9 below provides an overview of the key concepts of innovation as presented by the nine food sector interviewees (including one retail representative).

Table 9: Food sector interviewees' concepts of innovation

Concept of Innovation	Primary Focus	Goal
Outcome (I-2,I-11,I-21,I-24,I-25,R-1)	New: • Product • Service • Technology	Provide value: • Economic
Outcome (I-2,I-10,I-11,I-13,I)	Value: • Shareholder value • Business value • Buyer value	Provide value: • Economic
Characteristics (I-2,I-10,I-11,I-13,I-22,I-24, I-25,R-1)	New, timely, incremental or transformative, astounding: • Product • Package Human element: • Artistic creativity • Visionary • Action-oriented • Insightful • Lucky	Provide value: • Economic
Process (I-2,I-11,I-13,I-21,I-22)	Commercialization: • Of a discovery	Provide value: • Economic

Outcomes

All nine food sector interviewees equate innovation as an outcome: (I-21) perceives the outcome to be physical in nature only; two (I-10, I-13) perceive the outcomes to be value based only; and five (I-2, I-11, I-24, I-25, R-1) perceive the outcome to be both physical in nature and value based.

Two interviewees, I-2 and I-25, argued that innovation is the outcome of technological development. I-2 argued that *"technology is the innovation* that *allows new product categories to be established"*. This point is consistent with his argument regarding the *"BUTs and ANDs"* of innovation as noted above. Two examples of technology were provided. The first is the example of the various technologies developed that resulted in the development of the iPod. This example will be expanded upon below in the discussion regarding transformative innovation.

I-25 offered a second example. He discussed a new technology "*that extracts 98% of the water in a vegetable. The product can be used in a number of food applications for both packaged goods and food service uses. But it's the technology that's the innovation, not the product itself … too many people put the emphasis on the product but it's the technology that's the innovation".*

Two interviewees (I-11) believe that innovation is an actual product. At first glance, one of the interviewees, I-11, appeared to be promoting the concept that innovation is a discovery. At the outset he noted that *"innovation is a discovery that adds value to someone's existence"*. As the discussion progressed however, it became apparent that he equated discovery with the outcome of development – a product or technology. He provided the example that innovation *"includes everything from the discovery of the light bulb to how to cook a doughnut. But innovation only happens if it adds value to life – if it improves someone's life".* Upon further querying, he offered that discovery in his view is a product or technology. It is interesting to note that this person is the same one who identified the issue of *"the problem of language".*

I-24 believes that a product does not require sales to be considered an innovation. The innovation is the product or service that is the outcome of research and development. He argued that innovation "*happens at the point of development – once a product has been developed. It can be shelved and not make it to market for one reason or the other … Xerox developed a great storage cabinet. That product was not commercialized but it was still innovative. It offered specific benefits that our company could have used. Perhaps timing wasn't right. Perhaps they decided to invest in something else."* This argument is not consistent with those expressed by the FFNHP interviewees.

<u>*Outcomes – INTANGIBLE*</u>

Seven (I-10, I-11, I-13, I-22, I-24, I-25, R-1) of the nine food/retail sector interviewees identified innovation in terms of the creation of value either for the company or user. Of particular interest is the description provided by I-10. He equates innovation "*with value creation resulting from research and development … the improvement … on all facets of the business, from procedures and processes on the plant floor to accounting systems, to new products".* I-10 added that *"it's* [innovation] *a business opportunity. It provides the value proposition that allows us to make money and that's the only way it should be looked at".*

Value is also perceived from the user or consumer aspect. I-13 also argued that innovation is about adding value to someone's existence. An example was provided regarding the concept of organic products. *"Agricultural practices have advanced that enable companies to realize sustainable profits from organic products"*. He argues however "*that the real innovation is that consumers have added value to their existence through the commitment to consuming organic products … healthier options".* He argued that the innovation then is *"in the eye of the beholder".*

Innovation is perceived differently, depending on who is looking at it. R-1 offered that *"innovation is about changing the way consumers think"*. Therefore innovation is about how consumers see innovation and is consistent with I-13's point made in the previous paragraph. He claims that if consumers change the way they view or use something, in a manner that is new, then that is innovation. He provided an example of the iPod used by the researcher. While he acknowledged that *"the MP3 is a technical innovation, but there's no innovation in the Apple iPod. But the innovation is in the way Apple made consumers think about music. Consumers now see music as their choice, accessing only the parts they want and listening to it when and where they choose to. And that's why Apple is innovative".*

R-1 provided another example, development of the automobile by Henry Ford. While the car was a technical innovation, this interviewee argued that *"the real innovation was the way in which consumers of the car perceived transportation and the new benefits it opened to them, even if they didn't recognize its many benefits at the time".*

Finally, I-11 summarized by stating succinctly that "*there are three kinds of innovation: 1) innovation for the sake of innovation 2) innovation for the sake of benefit; and 3) innovation for the sake of commerce".* With respect to the first point, innovation for the sake of innovation, he argued that this approach is *"better termed scientific whimsy … there's too much focus on this type of innovation and should really not be considered innovation".*

With respect to commercial innovation, I-11 noted that it involved *"solving problems and therefore creating value for the company and must be the focus for industry".* He provided the example of a company that wanted to sell seafood that was high in omega-3. The company spent years of research from the *"innovation for the sake of*

benefit" perspective. "*But the fish … were too perishable. There were many years of research done on fish oxidation but nothing made the [fish source] of value that was palatable to consumers. We then decided to look at the 'problem' from a commercial viewpoint and examined potential packaging options. The problem was solved. The packaging used was adapted from another industry and we were able to sell hundreds of millions of pounds of fish after that. The point is that commercial innovation often entails only connecting the dots – adapting innovations from other industries and applying them to the food sector".*

This point of 'connecting the dots' will be explored below under characteristics.

Characteristics

Six (I-2, I-11, I-13, I-22, I-24, I-25) of the nine food sector interviewees described innovation in the context of *"new", "something that hasn't been thought of before",* or *"some novelty".* I-24 equating innovation to a product described the concept as: *"it's about a truly new product that consumers have never experienced and delivers benefits they have not received before".*

I-11 provided an example during the discussion regarding 'new' – *"MRE* [meal ready-to-eat] *pouch – that's a retort pouch that was a key innovation … a new package that acted like a can. It started with a need by the military and backpackers. The package not only holds the food, it is lighter, easier to transport and heats the food right in the kit. It's an innovation – a new cooking device".*

I-11, I-24, I-25 and R-1 discussed the element of timing with respect to innovation. The four equated innovation with a product and all but I-24 agreed that timing with respect to market acceptance of the product is critical. I-25 noted when describing the concept of innovation *"timing is one of the most critical points of all. The market may not be ready when you are. It's not an easy job to be a disruptor. Look at how long it took Microsoft and Bill Gates … Innovation is all about perfect timing".*

R-1 agreed that timing is critical. He provided the example of a concentrated laundry detergent, 2X launched by ABC in Canada in the early 1990s. *"It was the ultimate demise of ABC in Canada. In Canada, we like big boxes – big represented value back then. Consumers just weren't ready for the concentrated form when it was initially introduced. But they are now – innovation is all about timing".*

I-24 provided a dissenting view regarding timing with respect to innovation. He argued that success in the market should not be a limiting factor in characteristics of innovation. The example has already been given concerning the Xerox storage cabinet. In his view, inappropriate timing to market was likely a factor in its demise but he believes the product should still be considered an innovation.

The elements of incremental and transformative innovation were the fourth characteristic of innovation described by the food sector representatives within the context of the concept of innovation..

Two interviewees supported the view that innovation can only be considered incremental. I-10 provided examples of incremental innovation ranging from *"the development of equipment that eliminates the need for tilling soil"* to *"improving all facets of the business, from procedures and processes on the plant floor, to accounting systems, to new products … the Toyota model - of being lean in all things that company does".*

It is important to put the concept of incremental innovation into perspective – the concept that equates it to improvement. I-21 noted that he considered the introduction of a new system developed for their manufacturing facility to be an incremental innovation *"but it only saves us $50 million a year … but it's small steps".* The researcher wondered if a representative of a SME would consider such an outcome to be the result of an incremental or transformative innovation giving credence to the notion that innovation is in the eye of the beholder.

I-10 argued that if *"something is transformative, it's disruptive to an industry and that's not innovation. Innovation is about improvement. Innovation is about taking old procedures or ways of doing things and improving on them … after all, there isn't too much new under the sun, just new ways to do things better".* I-21 supported this approach expressing an astonishingly similar view that "*innovation is about taking practices and processes that are in the industry and trying to improve on them … Innovation is gradual and incremental. Innovation happens throughout scale-up through to the market. Another term for that* [innovation] *could be optimization".* This person also expressed the view that *"something that transforms or disrupts is an invention*, *not an innovation. Invention is an idea".* Interestingly, the same person noted that the iPod is a disruptive innovation that in his view "*is an exception to the rule*". It has changed the way music is delivered. He stated that the entire music

industry has been transformed by the iPod – *"a disruptive innovation"*. This dichotomy of thought is yet but one example of how interviewees' thoughts regarding innovation changed during the course of the interview. It also speaks to the complexities of the concept.

Two (I-2, I-11) food sector representatives also discussed the concept of transformative innovation. I-2 offered insight into transformative innovation by comparing it to incremental innovation. His description however was in the form of *"'small i' innovation and 'big I' innovation".* He noted that the first (small 'i' innovation) is "*about line extensions and builds on core competencies – which is incremental innovation. 'Big I' innovation creates new categories within an industry. It's transformative and much bigger risk. The real difference between 'small i' innovation and 'Big I' innovation is the level of risk. Transformational innovation usually involves a longer time horizon than incremental in its development stage and acceptance in the market … involves significantly more investment … and requires deep pockets".* He provided an example of a technology that was described in an academic journal in the mid 1990s. He followed the technology development during the following years. In 2002, he made contact with the equipment manufacturer that owned the technology. His company approved use of it in 2004 on a pilot scale basis and then incorporated it for use in the company in 2005-2006. While he noted that his company did not make the initial investment in the technology development which in his perspective was *"'Big I' innovation"* or transformational, the technology was in development over ten years before commercial application, with heavy investment by the equipment manufacturer.

The second interviewee, I-11, noted that innovation should be considered transformative, a concept that contains the elements of *"astounding and delightful … it's important to understand the 'cool factor' of innovation".* He described the high technology sector as not only focusing on transformative innovation, but that "*their consumers also expect transformative innovation".*

Similar to responses of the FFNHP sector, food sector representatives identified personalized descriptors, affiliating innovation as a personal attribute. Three food sector interviewees (I-11, I-24, I-25) expressed the view that any definition of innovation must include the innovator as the core of the concept. All three interviewees equated innovation as an outcome – new product – at the outset and then gravitated to personalized descriptors. I-11 also equated innovation to a

process at the outset of the interview and then developed his thoughts within the context of personalized descriptors throughout the interview.

I-11 equated innovation to artistic creativity. He continued that innovation was not about science but rather *"art – the art of the innovation … innovation is a mindset … and is individual driven … the mindset is entrepreneurial … it's a risk taking factor to the point of bankruptcy".*

I-25 captured the concept of the personalization or individualism of innovation by noting that innovation *"is about excitement, love of the idea, and belief in the idea"*. I-24 added that it is the *"vision to see opportunities".*

I-11 was committed to linking innovation with the innovator and his/her ability to connect known entities to create something of value. He began by utilizing the metaphor of a symphony. "*The innovator thinks and acts quickly. Innovators apply their brilliant thoughts, by mapping, linking, combining known science and known technology. They are the artists. They are the conductors of a symphony that bring the sights and sounds together to create an innovation'.*

I-11 continued utilizing the iPod as an example. Unlike others who identified the iPod, the product, as the innovation, he focused on the iPod as simply a combination of technologies. This interviewee described the MP3 technology that allows for the digitization of music. Second was the technology that allowed a hard drive – the actual iPod – to be encased in such a tiny receptacle. Third, the iPod provided a simple interface that allowed for easy navigation by the users. Fourth, iTunes – a searchable database of music – was developed and established on the internet that allowed consumers to access cheap music. Fifth, technology was accessed that allowed consumers to pay with ease through the internet at a reasonable rate, for example ninety-nine cents per tune. He used this example to explain that "*each technology had been used before, but it was the ability of someone or a team at Apple Corporation who had the insight to connect the dots and that transformed the music industry. Apple just got it so right".*

The insightful attribute was also noted by I-24. He argued that the development of the iPod demonstrated *"outstanding consumer insight innovation".* He expressed the same belief as one other in this group who noted that innovation is the *"ability to connect the dots … adapting innovations from other industries … mapping and*

linking known science and known technology and ideas to make something new … innovation is in the eye of the innovator".

Also within the realm of personalization of innovation is the identification that there is a serendipitous element to innovation. Two food sector interviewees, I-11 and I-25, expressed the view that innovation can entail luck. They both equated luck with market readiness for uptake of a new product. I-25 qualified the luck be stating "*luck equals preparation meeting opportunity".*

Process

Five (I-2, I-11, I-13, I-21, I-22) of the eight food sector interviewees include a process within their concept of innovation. The argument put forward was that innovation is not an idea nor a discovery, but rather the commercialization process of the idea or discovery.

I-22 representing a multinational enterprise noted that innovation is a process that begins with the company vision, then applies both internal and external ideas to meet a company's commercial goals and brings value to that company. Another interviewee stated simply that *"innovation is a process and in this case it's about moving agricultural products into new, value added products for food*".

4.1.3 Definition – actor group: research/academia

The six researchers/academics interviewed struggled less with their definition or concept of innovation. While four of the six refined their concept throughout the interview, it was more of a refinement of their view with no radical difference than was observed during the discussion with the industry actors.

Table 10 below provides an overview of the key concepts of innovation as presented by the six academic/researcher interviewees.

Table 10: Academic/research interviewees' concepts of innovation

Concept of Innovation	Primary Focus	Goal
Outcome (A-4,A-6)	New: • Product • Technology	Provide value: • Economic
Outcome (A-2,A-3,A-4)	Value: • Benefit to business • Public good benefit	Provide value: • Economic • Social
Discovery (A-1,A-5)	Create new knowledge	Apply knowledge to create economic value
Characteristics (A-1,A-4,A-5,A-6)	New, timely, market-driven, radical, incremental, multi-dimensional: • Product • Technology • Process	Provide value: • Economic • New knowledge
Process (A-1)	Application of new knowledge	New product or process

Outcome

Two research/academic interviewees (A-6, A-4) perceive innovation as a physical outcome although one was more implied than a definitive claim. A-6 adamantly maintained that innovation is a tangible product. He argued that *"innovation is different than discovery. Discovery is about something novel. But innovation takes that novelty and puts it into a practical purpose – usually a product. Many people talk about an innovative idea. But an idea is NOT an innovation. You can't patent an idea. It must be something tangible. Innovation is a result – it is a tangible thing … A bioactive when discovered is not an innovation but rather a scientific curiosity. It's only when someone develops a product with that bioactive that the innovation occurs."*

A-4 provided an implied support for that view. He argued that *"innovation is about changing something. It's creating something new. BUT it must be accepted into the marketplace. Therefore, an idea with no practical application is not an innovation".*

Adding to his concept, he discussed value as an intangible outcome concept of innovation. He argued that any definition of innovation must include the value that innovation adds to the company. To be an innovation, he believes that it *"must prove some benefit to the bottom line"* [of the company] either through increased savings on costs to the company or increased revenues.

A-2 supported this view of value and also considers innovation to be a process. Unlike the first researcher however who views the concept of innovation within the context of adding value to a company's income statement, this researcher views value from a public benefit perspective. He claims that innovation is difficult to quantify, unlike measuring the increases or decreases in corporate income. This concept will be discussed further below.

A-3 also discussed innovation within the context of the outcome derived. He argued that the expected outcome is different depending on the industry of interest. He explained that "*innovation applies to all organizations. It isn't different but the various elements of it may be different depending on the industry. For example, it would be different in retailing than in research. In retailing, the emphasis may be on value management whereas in research the emphasis is on knowledge management".*

Discovery

Two researchers (A-1, A-5) support the view that innovation is about discovery. A-5 qualified her remarks by noting that the "*discovery must result in commercial success … which validates that the invention or discovery is an innovation".* This argument is different than the interviewees who express an outcome of value as innovation. She argued that the outcome or *"the value to the company derived from commercial success is the measure and not the innovation. The innovation is the discovery".*

The other researcher, A-1, agreed and was even stronger in his description. He argued that *"innovation is discovery. Knowledge transfer is commercialization. Innovation is a discovery and applications such as biotech or NHPs are end products".* He provided the example of an innovation in the FFNHP sector. *"The discovery of the understanding of the functionality of a bioactive is the innovation … the innovation is the advancement of the understanding of how the food or ingredient functions within the body".* In his view, knowledge transfer of the innovation or discovery is *"commercialization, a cornerstone transferring innovation to the market. And the problem is that none of us know how to commercialize innovations … none of us know how to do it".*

A-1 noted that educational institutions struggle to *"get economic value out of innovation. While there are a lot of ideas and innovations developed in universities, Canadians just don't have the ability to turn innovation into applications that provide economic returns. Universities need to carve out the link between discovery or*

innovation and the application of it". He clearly distinguishes innovation from commercialization and argues that the *"focus should be on understanding commercialization"*. He expressed the concern that *"focusing research on commercialization will be a challenge since universities are generally regarded as limiting their interests and expertise to research and publishing the results".*

Characteristics

Seven characteristics of innovation were discussed by the academic/research interviewees: new; patentability; timeliness in the market; market-driven; radical; incremental; and multi-dimensional.

The characteristic of newness was noted by A-4 and A-5. A-4 argued that 'new' provides a context for his equating innovation with a physical outcome – *"it's about something that hasn't been done before"*. He gave the example of the development of a specific technology developed by a Canadian company that provides standardization of natural health products. This technology to his knowledge was a significant innovation in that *"it hadn't been accomplished before. It met the consumer demand for NHPs that provided a standard amount of bioactive ingredient in each capsule. That just hadn't been done before".*

Another characteristic identified was patentability. Only two researchers (A-1, A-6) discussed patents or patentability and interestingly, neither equate patents within the realm of innovation.

A-1 identified a patent as a process that follows a discovery. For that researcher, discovery equates to innovation. He expressed concern that *"the issue for researchers and universities is patent applications. Universities are now focused on patent protection but they don't teach us how to get something out of an innovation. Who really has the ownership of a discovery or innovation? All universities have different policies? The patents haven't generated the money that was expected for the universities".* He argued that while innovation is important, commercialization or implementation that results in a social benefit is difficult to achieve.

Rather than patents following innovation, A-6 argues that patents and patentability are precursors to innovation. This researcher equates innovation to a physical outcome. He provided examples of several patents resulting from discoveries he and his colleagues have made. He argued that the patented discoveries were then

licensed by companies and developed into tangible outcomes (i.e. products). It is his supposition that it is the outcome or the product that is the innovation.

These same two researchers also were the only two of the six who discussed timing within the context of innovation but both discarded the notion that market success should be considered a measurement of innovation. A-1, the one who equates discovery to innovation, noted that innovation often fails to capture value due to the time involved in making discoveries. He discussed the challenge faced by researchers who investigate certain areas of science to find solutions that address public or consumer issues. He observed that by the time a discovery or innovation is made, which could be ten years after investigation is commenced, consumers *"will have changed their attitudes".* He argued that these changing consumer attitudes are another reason why research institutions and universities have been challenged to receive economic returns from investment in innovation.

The second researcher addressing timing of the innovation in the market, equates innovation to a physical outcome. He argues that a product can still be considered an innovation even if the product is not introduced to the marketplace. He argued that the product could be *"ahead of its time, too radical, the marketplace just can't handle it at that time or it may not be understood by the consumer".* He argued that the product could still be an innovation.

This researcher added that if an innovation is introduced to the market later (i.e. several years later), the product or the innovation has changed or evolved and is usually a second generation product as often occurs in the technology sector. He argued however that the first generation product should still be considered an innovation.

The key point is that both researchers understand the issue of the timing of innovation as it relates to successful market uptake and both have dismissed it as a qualification to innovation.

A-4 qualified his concept of innovation in the context of being market driven. He described innovation the following way: *"Innovation is about responding to a demand or a need in the market … it's* [innovation] *about an identified market opportunity. If an opportunity is identified, then an innovative technology can be developed to*

respond to the need. The biomass extraction process is a great example of an innovation that responded to a need in the market".

Only one (A-5) of the six researchers discussed the descriptor of *"radical",* which she considers to be transformative, and incremental innovation. She suggested that radical innovation occurs much less often than incremental innovation. She argued that radical innovation involves a new or novel product concept or delivery mechanism, *"a complete change in a product",* a new process or new distribution system. In all cases, she continued that *"change must be a radical departure from what was traditionally used or delivered"*. She provided the example of Yakult, a Japanese fermented milk drink combined with bacteria that improves the digestive tract, packaged in a single daily dosage bottle. It was first introduced to the Japanese market in the mid 1930s. She observed that *"it was a radical change from how consumers received their nutrients. And the other radical innovation with Yakult was the use of 'Yakult Ladies'. They delivered the product directly to various businesses and to the elderly. Taking the product directly to the consumer was considered to be a radical departure from the norm – a radical innovation".*

A-5 observed that all too often radical innovation results in the immediate spawning of similar products which then dilutes the sense of innovation and newness.

With respect to incremental innovation, she argued that *"there is nothing bad about incremental innovation. Companies can make a lot of money in it AND* [her emphasis] *it's less risky. Investing in incremental innovation usually costs much less and takes less time to get to the market than radical innovation".*

The final descriptor or characteristic of innovation identified was that of mindset and creativity. A-3 argued that most people consider "*innovation to be one dimensional but actually is multi dimensional".* While this researcher originally laid the foundation of his concept of innovation as being a process, beginning a new way of doing something, he then argued, that innovation is actually *"a state of being … a mindset … it's* [innovation] *about creativity".* He argued that if companies understood that innovation is about mindset, then outcomes that result in value for the company or organization would be forthcoming.

Process

As noted above, A-1 argued that innovation is about discovery and the application of the knowledge is the commercialization process. A-2 however argued exactly the opposite, arguing in favour of a process – the process of the application of knowledge resulting in an outcome. He emphatically stated that innovation does not equate to discovery but rather is *"a systematic form of change where knowledge is applied to bring about new products or processes … it* [innovation] *is a wilful application of knowledge".* This researcher qualified his statements by arguing there must be an outcome of innovation which could be in the form of a new product, process or input into a final product. He offered as an example a gene gun as an application of knowledge that results in a new product or process. The gene gun is *"a delivery system that injects cells with specific genetic information".*

4.1.4 Definition – actor group: government

Six interviewees affiliated with government were interviewed: five public servants representing four different federal departments and one politician. The politician provided his input only on policy-making and therefore offered no input to the first research question.

Two interviewees, G-1 and G-3, stated that government usually refers to the *"Oslo"* definition of innovation as described in Section 1.2.1. G-3 noted that the Canadian policy is generally based on that definition. When asked to provide a description of it or his interpretation, he stated that the definition could be found on the internet.

G-1 suggested that while the Oslo definition is widely used, he is troubled by its wide scope. He noted *"essentially, it* [the Oslo definition] *is that any change is an innovation".* He argues that the definition is too broad and requires more focus. He believes that *"the change must have a recognizable benefit that results in profitability or competitiveness".*

Interviewees also noted the challenges of varying understandings of innovation within government. As G-2 noted, *"there are differing views even in our own department regarding the nature of innovation".* G-2 represents a different government department than G-1. He expressed concern regarding the varying understandings of innovation across and within departments. He also noted the importance of a common understanding by stating *"the definition of innovation must be understood and agreed to otherwise it's impossible to develop policies that allow for it".*

Two interviewees (G-1, G-4) however spoke of the challenge due to the complexity of the definition or concept of innovation. G-4 referred to the complexities resulting from the *"emerging science and technology convergence phenomenon that results in new, unforeseen domains".* This convergence is described further below.

Table 11 below provides an overview of the key concepts of innovation as presented by five government interviewees.

Table 11: Government interviewees' concepts of innovation

Concept of Innovation	Primary Focus	Goal
Outcome (G-3)	New: • Product • Process	Provide value: • Economic
Outcome (G-1,G-2,G-3,G-4,G-6)	Create: • Recognizable benefit • Cost reduction • Competitive advantage	Provide value: • Economic
Discovery (G-2)	Create new knowledge	Apply knowledge to create new product resulting in economic value
Characteristics (G-1,G-2,G-3,G-6)	New, market-driven, timely, transformative or incremental: • Product • Technology • Process Human element: • Creative • Original thought	Provide value: • Economic • Social benefit
Process (G-1,G-3,G-6)	• Linking new ideas with policy • Overcoming impediments in the marketplace	Provide value: • Economic • Social
Systems (G-4)	• Knowledge sharing • Creation of social networks	• Creation of new domains • Competitive advantage

Outcome - physical

Only one government interviewee, G-3, identified innovation as a physical or tangible outcome noting that "*it could be a product or process albeit new … innovation is about practical application, practical results".* Throughout the interview however, he waffled between innovation being a practical or tangible outcome and a process and will be discussed further under process.

Outcome - intangible

All five government interviewees described the concept of innovation as an intangible outcome of benefit. Three people (G1, G-3, G-4) qualified their comments however by stating that the benefit must be recognizable and result in profitability or competitive advantage. An example provided by G-3 of a benefit was *"cost reduction in manufacturing resulting in a competitive advantage and profitable outcomes"*. One may argue that the benefit itself as he described must be a result of the implementation of a new technology, piece of equipment or process/method somewhere in the supply chain. But in his view, it is the benefit leading to a competitive advantage that entails the concept of innovation. He continued that "*any definition of innovation should be viewed from the perspective of industry because the benefit derived from innovation will bring benefit to the country … innovation is the heart of competitive advantages".*

G-4 noted that the "*current innovation focus of the Government of Canada is about economic outcomes and achieving it is a huge issue".* Note that this last comment was offered from the perspective of government. His view on innovation will be offered later in the section.

The final government interviewee, G-6, argued that innovation is about the outcome of benefit derived but not necessarily measured in economic returns. She argued that *"economic returns too narrowly define the concept of innovation".* Her example of an intangible outcome was the *"repositioning of an organization … And from a government viewpoint, repositioning could result in new programs and targeted funding of research".*

Discovery

Only one government interviewee, G-2, described innovation as a discovery. He discussed the discovery of a new bioactive or the discovery of a linkage between a gene and a specific disease. He argues that the discovery is innovation and the resulting applications of the discovery into new products or technologies are simply that – applications.

Characteristics

Four (G-1, G-2, G-3, G-6) of the five government interviewees responding to this question used descriptors of new, market-driven, timely, incremental, transformative and creative.

While two interviewees referenced the description directly to the innovation, whether it was an outcome, discovery or process, three interviewees expanded the scope of new. They referred to innovation that results in "*new lines of business"* (G-1), *"new players"* (G-3) with respect to any part of the demand network or *"new programming"* (G-6) with respect to non commercial organizations.

A second innovation characteristic identified was market-driven. G-2 views innovation as being multi-faceted – an outcome, a discovery and a process – arguing that the discovery or innovation must be market-driven. He noted that scientific investigation should be targeted and that discovery/innovation addresses a problem. He argued that innovation *"must be relevant and solves a problem or a need not being met … And once it goes mainstream, it's no longer an innovation"*. This last point was consistent with industry interviewees I-3 and I-17.

Two government interviewees (G1, G-6) discussed a third characteristic of timing with respect to innovation. They offered opposing views whether timing was a qualifying descriptor of innovation.

G-1 argued that timing is a descriptor linking innovation to profitability. He expressed the view previously that innovation equates to the benefit of profitability and competitiveness. He offered that "*innovation resulting from scientific discovery is complex as some science takes ten years to even get to the discovery stage. If the timing for market entry is not right for various reasons, or if the application of the discovery requires an additional ten years, then the net present value of the investment to the company results in no benefit* [i.e. competitive advantage or profit] *to the company. No benefit, no innovation. In that case, the innovation cannot be considered to have happened. As I said, it's complex."*

The second interviewee who discussed timing offered opposing views. G-6 had previously argued that innovation should also be considered a benefit. But she observed that "*perhaps the innovation or benefit is not sufficient for implementation. In government and business lots of things don't get implemented for all sorts of reasons but that doesn't mean the benefit or the innovation isn't there … marketers determine if innovations are commercialized or implemented".*

To illustrate her point, G-6 provided the example of Snackwell's, a low fat cookie produced by Nabisco. To address the demand for low fat foods, Nabisco determined that the company would need to reduce the fat level of the already fat reduced product line. According to the interviewee, the company *"spent millions of dollars"* developing a micronization technology and the affiliated infrastructure requirements to reduce the fat level further. *"But in the end, the marketing department decided that 2% fat really wasn't that big a deal … so Nabisco never did implement it. But it is still innovative even though it wasn't implemented".* The innovation in this case was the benefit of a much reduced fat level in cookies, a level that had not been achieved previously.

Only one interviewee, G-1, discussed in some detail the descriptors or characteristic of incremental or transformative innovation. This person also defined innovation through the benefit of profitability and competitive advantage. He observed that when people speak of innovation, they are most often referring to incremental. Incremental in his view is *"tweaking the system or the product or the technology".* He argues that this type of innovation is the major focus of most businesses in Canada. He continued that *"they are managing what is and don't want to make drastic change. The cost is too high".*

G-1 summarized incremental and transformative innovation by arguing that *"incremental innovation fixes what is and transformational focuses on what might be".* He argues that the innovation, or the benefit, is new lines of business or the involvement of non traditional players in the sector. Interestingly, he argues that *"transformative innovation involves new players. It occurs likely from people not in the industry"*. He provided the example of the car industry. He observed that the North American car industry is entrenched and therefore risk averse.[5] As a result its focus is on incremental innovation. The auto sectors in China and India however are relatively new entrants and *"have introduced transformative innovations that are beneficial to their populations needs: small, affordable and economical to run".*

Transformative innovation G-1 argues emanates from SMEs that are considered by the mainstream industry to be *"wing nuts … The MNEs troll these companies for their innovations".*

[5] Note that the interview was conducted prior to the 2009 U.S. and Canadian government bail-outs of the North American auto industry.

On a final note regarding the discussion of incremental and transformative innovation with G-1, he interchanged the use of transformative and disruptive innovation during the course of the interview. He views the two concepts as being the same.

The final characteristic was that affiliated with creativity. G-2 argued that innovation *"should be perceived as originality of thought".* When questioned further, he remarked that this concept involves the creative process and thus should be considered a characteristic either of a person or a collaborative team that often occurs against a scientific backdrop.

Process

Three interviewees discussed innovation as a process. The first one, G-6, also considers innovation to be an intangible outcome. But when asked to summarize her thoughts regarding the concept of innovation, she argued that innovation happens throughout the process of discovery, development and application of the discovery.

While he maintained the outcome approach to innovation of economic benefit to a company and country, G-1 added the action of linking is a process in itself. This government interviewee argued that *"it's* [innovation] *about bridging of new ideas with the policy environment … it's about building a pathway for new products and process … it involves multiple players across the value chain and requires communication, IP* [intellectual property] *and overcoming impediments in foreign markets".* G-1 articulated and provided a broader picture of a process than had previously been presented by the other interviewees and may be more in line with a network or a system. A conclusion of his remarks then might be that innovation in the government setting therefore is about providing a platform or process that enables commercial innovation.

System

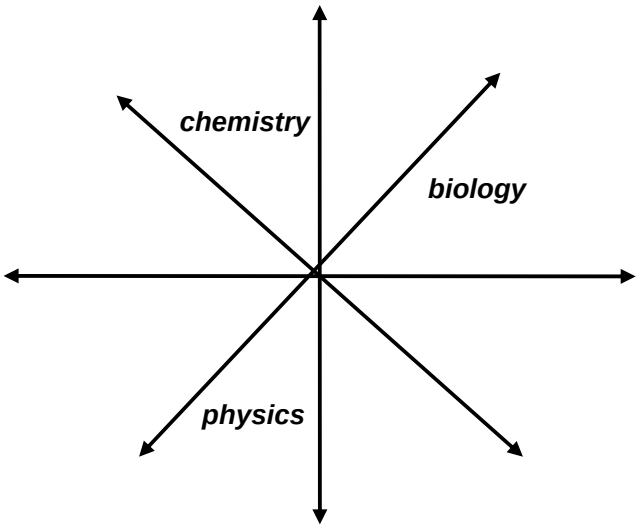
One final concept on innovation arising from the government interviews was the notion of a system or systems of innovation.

G-4 argued that innovation should be considered *"a system. Innovation is about progress and ideas. It involves aspects of infrastructure, social mechanisms and commercialization – the breakdown of commercialization. Innovation is about knowledge sharing. It involves social mechanisms that allow for sharing".* Social mechanisms in his view include platforms for and establishment and growth of social

networks. *"These social networks form the foundation of knowledge sharing and collaboration".* He argued that innovation, or *"systems of innovation provide an outcome of a competitive advantage for a company, industry or a country".*

G-4 also argued that *"innovation systems include the emerging convergence phenomenon of science and technology".* As demonstrated in the following diagram, drawn by G-4 during the interview, "*the boundaries of chemistry, biology and physics and other science and technology domains were once considered to be unique or mutually exclusive fields of endeavour but are now converging".*

Figure 26: Convergence of science and technology domains



G-4 continued that *"the convergence of the science and technology domains has resulted in new, unforeseen domains including new or unforeseen markets. An example of this phenomenon using technological domains is the development of the Blackberry",* a smart phone device. *"It's a result of the convergence and high integration of the domains of nanotechnology and information technology".* He argues that the higher the level of integration of the domains, the more difficult it is to replicate providing a competitive advantage in the marketplace. *"The Blackberry demonstrates an example of phenomenal market success".*

The concept as presented entails the ability to recognize the significance of apparently disconnected puzzle pieces and translates the insight into public and/or private benefit.

This interviewee argues that the very foundation of this innovation system, *"the key glue in the integration is the social glue … and includes private industry, academia and government".* While research and educational institutions have kept the domains separate in the past, the rise of social networks among participants in the various domains is facilitating the breakdown of those barriers. He explained that *"the challenge for government policy in innovation is how to best enable and facilitate the social glue"*.

4.1.5 Definition – actor group: non government organization

Two representatives of NGOs were interviewed. Both were clear and concise regarding their interpretation of the concept of innovation and spent more of their interview time on other questions. Their primary arguments were based on innovation as an outcome that results in value.

Table 12 below provides an overview of the key concepts of innovation as presented by the two civil society/NGO interviewees.

Table 12: Civil society/NGO interviewees' concepts of innovation

Concept of Innovation	Primary Focus	Goal
Outcome (NGO-1,NGO-2)	Application of research that creates value	Provide value: • Public good • Economic • Social • Health • Environment

Outcome - Value

Both interviewees equated their concepts of innovation with value. NGO-1 began by referring to *"innovation as the application of research".* It is his experience that the majority of people believe the results of research activities are the innovation. He argues however that "*the research must be applied and used and must entail a benefit either from an economic or a public good benefit".*

NGO-2 concurred with the application of research into *"something that is useable resulting in a public good benefit".* He focused his argument on innovation being

"solutions that will provide economic, social, health and environmental benefit for citizens … it's about providing benefits to a society".

The two interviewees in this actor group argued that only when benefit is derived, can innovation be considered to have occurred. NGO-1 offered two examples of an innovation. The first was the development of the Enviropig^{TM}, a transgenic pig developed at the University of Guelph. "*The key benefit offered by this new pig is the reduction of the phosphorus content of the manure by as much as sixty percent. The public good benefit is less damage to the water system"*. His second example was spearmint tea. He explained that *"research established that the herb spearmint provided health benefits. The application of that research into a tea provided not only economic benefit to companies but a health benefit to consumers of the product and thus a public good benefit"*. The benefit derived therefore qualifies the tea to be considered an innovation from NGO-1's perspective.

NGO-2 added to the discussion regarding value. While not directly discussing systems of innovation, he argued that innovation "*is about building on shared values".* His view is that *"innovation is about collaboration in the value chain which includes government and their initiatives … and in this instance, the need to bring value back to the farm and the farming community".*

4.2 Innovation in the Canadian functional food and natural health product sector

As a follow-up question to the definition of innovation, the interviewees were asked to comment on the question regarding whether they believe the FFNHP industry is innovative and provide their rationale for their response. Note that the food industry interviewees responded to this question as they see a melding of the food sector with that of the functional food or healthy food sector. This point will be expanded upon below.

Table 13 provides an overview of the responses. The table identifies five categories of responses given to the question: 1) yes; 2) yes-qualified (indicating that the respondents replied in the affirmative at the outset but then qualified their response by stating that some companies in the sector are innovative); 3) no; 4) no-qualified (indicating that the respondents replied in the negative at the outset but then qualified their response by stating that some companies in the sector are innovative); and 5) don't know. As in the previous question, the response of the retailer is linked with

those of the food sector representatives. In addition, the politician did not respond to this question.

Table 13: Would you describe the functional food and natural health products' sector (FFNHP) *[or food sector]* in Canada as being innovative?

Respondent Category	Yes	Yes-Qualified	No	No-Qualified	Don't Know
FFNHP	2 (1-18,I-19)	4 (1-3,I-5,I-8,I-9)	6 I-6,I-7,I-12,I-14,I15,I20)	4 (I-1,I-16,I-17,I-23)	1 (I-4)
Food / Retail			5 (I-11,I-13,I-21,I-24,R-1)	3 (I-2,I-22,I-25)	1 (I-10)
Research / Academia		1 (A-7)	1 (A-6)	3 (A-4,A-1,A-2)	1 (A-3)
Government	1 (G-1)	1 (G-6)	2 (G-2, G-4)		1 (G-3)
NGO			1 NGO-2	1 NGO-1	
Total	3	6	15	11	4

Only one of the seventeen FFNHP interviewees differentiated between innovativeness in the functional food segment and natural health product sector. I-9 argued that the functional food segment was not innovative while the natural health product segment of the Canadian sector can be considered innovative. He added however that many of the NHP companies are simply packagers of herbs or ground products. *"Those companies are certainly not innovative but just taking advantage of uninformed consumers".* I-7, supported by I-20 and I-23, also noted that there are too few transformative products and *"far too many 'me-too' products … there's nothing innovative about that"* for this sector to be considered innovative. I-20 concurred and stated that based on the competitive intelligence conducted in her company, *"we just don't see a lot of innovative products out there."*

As indicated above, only three interviewees, or eight percent of the interviewees believe that the FFNHP sector can be considered at this time to be innovative. The first one (I-18) predominantly equates innovation with discovery. The second (I-19) equates innovation to an outcome, both physical and intangible outcomes. And the final of the three (G-1) equates innovation with an intangible outcome only.

Fifteen interviewees or thirty-eight percent of all interviewees believe that the industry is not innovative. Seventeen interviewees (six responding with a qualified yes and eleven responding with a qualified no), or forty-four percent of all interviewees indicated that innovation is occurring in the sector at some level but more within specific companies rather than across the sector.

Also note that, although not asked, nine FFNHP interviewees offered that their companies are innovative. Three of the nine interviewees gave a qualified affirmation that their sector is innovative (I-8, I-9, I-1). Two of the nine believe the sector is not innovative (I-12, I-20). And four of the nine responded with a qualified negative response (I-4, I-16, I-17, I-23).

During discussions, eleven interviewees identified thirteen companies, organizations, other than their own, or persons that they believe to be innovative. I-7, I-9, I-15, I-19, A-2, A-4, A-6 and G-2 identified CV Technologies of Edmonton, Alberta as being innovative. Note that the company rebranded itself to Afexa Life Sciences Inc. in April 2009. I-9, I-15, I-19, A-2, A-4, A-7, NGO-1 identified Ocean Nutrition Canada of Dartmouth, Nova Scotia. A Coquitlam, British Columbia company, Natural Factors was noted by I-15, I-23, A-4 and G-2 as an innovative company. I-15, A-4 and G-2 noted Toronto, Ontario's Genuine Health as innovative. Forbes Medi-Tech of Vancouver, British Columbia was cited by I-7, A-6 for its innovativeness. Note however that this company has recently divested itself of a focus on functional ingredients to devote its work on pharmaceuticals. As well, while the company is Canadian owned, A-6 stated that the company's research and development is conducted in Texas. I-17 identified BC Hothouse for innovation adding that the company is a *"great story about innovation".* While not a FFNHP company, it supplies vegetables year round to the Pacific Northwest region of North America. He noted that innovation in this case was defined as the branding of individual peppers, offering traceability in the supply chain for its produce which had never been done before. And finally A-2, A-6 identified London, Ontario's KGK Synergize Inc. and Emerald Seed Products Inc. of Avonlea, Saskatchewan as innovative companies. A-4 identified Pizzey's Milling and Nutritionals of Angusville, Manitoba. This company was purchased by Glanbia plc of Ireland in 2007.

NGO-1 identified a non commercial entity as being innovation, the Institute of Nutraceuticals and Functional Foods (INAF) centered at Laval University, Quebec

City, Quebec. He also identified organizations that *"have innovative capacity – pockets of research"*. They are the Richardson Centre for Functional Foods and Nutraceuticals at the University of Manitoba and the Advanced Foods and Materials Network referred to as AFMNet spearheaded out of Guelph University in Ontario.

Of specific interest is that a person was also identified as an innovator. I-13 argued that Yves Potvin of Garden Protein International, Richmond, British Columbia was an innovator *"for his foresight in understanding the vegetarian market pull before anyone else".* NGO-1 also identified Potvin's company as being innovative.

The following section provides a broader explanation of the rationale supporting the responses. The rationale can be generalized in four categories: uniqueness of the food/nutrition sector with respect to the concept of innovation; expected outcomes of the sector; company/sector competitive advantages; and challenges or barriers to innovation in the FFNHP sector. The explanations are outlined again by actor category: FFNHP; food/retail; research/academia; government and NGO representing civil society and public.

4.2.1 Sector Innovation – actor group: functional food and natural health product sector

Nine interviewees or fifty-three percent of the FFNHP sector interviewees stated that they believe their own companies to be innovative. Two (I-8, I-9) gave a qualified yes response to whether the sector is innovative. Two of the nine (I-12, I-20) believe that the sector is not innovative. Four (I-1, I-17, I-23, I-16) provided a qualified no response to the question of whether the sector is innovative. One interviewee believes his company to be innovative but does not have an opinion ("don't know") regarding the rest of the sector.

Interviewees offered varied reasons why their companies were innovative. On one end of the spectrum, I-1 offered that his company is innovative because *"it is our brand promise. We see it through the eyes of our customers. We are responsive to their needs and try to find innovative solutions for them."* His rationale was consistent with his concept of innovation as an intangible outcome. He also offered that fifty percent of his company's efforts focus on transformational innovation and the other fifty percent focuses on incremental innovation. At the other end of the spectrum was I-8 who stated that *"we are innovative because we've been given two awards for innovation".* His concept of innovation combines the intangible outcome concept with the characteristic of being entrepreneurial.

Uniqueness

Ten FFNHP interviewees described the uniqueness of the sector(s) as rationale for their response. Uniqueness itself was differentiated with respect to uniqueness from industries other than those whose foundation lie in agricultural and marine sources; uniqueness from the food sector; and uniqueness between the two segments of the sector, functional foods and natural health products.

Uniqueness from industries other than those whose foundation lie in agricultural and marine sources: The rationale was based on differences in margins and biological sources.

I-9 believes that innovation is different in this sector from those industries whose foundations lie in sources other than agriculture and marine. He argues that *"margins for food are much tighter than for other industries and therefore companies are less willing to focus on transformational innovation … Food companies in general in Canada are laggards with respect to new products and processes because of the issues of small margins. But they are more innovative in the area of branding and marketing"*.

I-12 and I-20 argue that this sector is different because it deals with nature. I-12 suggests that *"nature invented natural health products. You can't be the innovator of nature".* I-20 supported that view noting that this sector is unique *"because there are so many variables that can happen – too much rain, too little rain, poor soil conditions"* that affect the inputs to innovation more than other industries. She defines innovation therefore as *"bringing ancient knowledge to western medicine – a market that has not used it previously".* For example, ginseng, traditionally associated with immunity, has been used for centuries by the Chinese and North American aboriginal populations.

I-20 argued therefore that innovation is about standardising the bioavailability of the component that provides the health benefit or *"standardising ancient knowledge"*. I-12 concurs with that rationale stating *"the innovation is extracting these natural molecules, making them stable and mimic nature when taken in dosage format".*

Uniqueness from the traditional food sector: The rationale surrounds eight factors: the regulatory environment; degree of innovation; communication

requirements; food formulations; new product development and time to market; level of maturity; psychological connections with food; and margins.

The current regulatory environment in the country distinguishes innovation in the FFNHP sector from that in the food sector. I-7 argues that innovation in the food sector is *"all about packaging and processing while the functional food and natural health product sector is a grey area between food and drugs. Health Canada doesn't understand it and that inhibits innovation".*

The regulatory environment was a key theme throughout the interviews and is discussed further below under challenges.

I-1 stated at the outset of this question that *"innovation in general is the lifeblood of the agri-food industry".* He continued that the difference was in the degree of innovation. While the Canadian FFNHP sector is *"more transformational than the general food sector and it should be, the general food sector just focuses on incremental innovation*". He claims that *"in the food sector in general, ninety percent of the company's effort goes into incremental benefit tweaking of a product. The remaining ten percent of the effort in innovation is targeted at transformational innovation … entirely new products for entirely new markets".* He gave the example of such a product as a barley-based cat litter product which is completely biodegradable. He continued that in the FFNHP sector, the ratio between efforts on transformative innovative and incremental innovation should be exactly opposite. He argued that while *"it should be that way, it isn't … the industry needs to be a lot more transformative. Funding for transformational innovation is so much easier to get than for incremental innovation"* from both the public and private sectors.

The differing levels of effort required to communicate benefits was also perceived as a distinguishing factor between the food and the FFNHP sectors. I-5 noted that *"the FFNHP sector is much more deliberate … FFNHPs contain ingredients such as probiotics and omega-3s, allowing consumers to buy into the concept of good health quickly".* Innovation in the food sector he argues requires *"a lot of education to get the message out to consumers about what the nutritious constituents are of food … and it's a fair amount of work to do that".* The FFNHP sector he concludes therefore is much more innovative because the opportunity to communicate the benefits of innovation *"is much easier and clearer".*

I-18 also believes that innovation in the FFNHP sector is different than the food sector. He gave the example of saw palmetto (a health promoting plant) whose flavour is difficult to mask in a food. He argues that innovation in this sector is not only about the process that must be adhered to but also *"perfect formulations … the masking of many health promoting ingredients so that their taste is imperceptible to the consumer. This raises the level of innovation required over the food industry".*

Time to market was also noted as a distinguishing feature between the two sectors. I-19, who argued that the FFNHP sector is innovative, stated that innovation is different in FFNHP to that in the food sector based on the length of time to market. She noted that innovation is founded on scientific evidence which in this sector *"can take up to 10 years from idea to commercialization. That's far longer than in the food sector. That's what makes innovation in this industry".*

I-23 suggests that this sector is unique from that of the food sector because *this industry isn't mature. There is so much unexplored territory".*

I-17 and I-20 discussed psychological connections to food which makes innovation in that sector different than in FFNHP. I-17 noted that innovation in *"food in general is about rituals – about family outings but FFNHP is about health".* I-20 observed that food itself is different because people form an emotional connection with food *"far more than for other products".* Food in her perspective has been used for *"comfort, reminiscences of previous occasions and people and a form of communication with friends and family … food is just so much more in our society than just an energy source. It's all about emotions".*

Although not articulated in quite that manner, I-18 supports that observation and added that the functional food sector is about *"perfect formulations so that food, the sacred elements of consumers, can be presented in the same manner, taste and texture with an added health benefit"*. He gave the example of needing to find the perfect formulation for a weight control or weight management product. Consumers of these products are not emotionally attached to them so the goal is to present them in a manner – taste, texture and smell – that equates to the products with which they enjoy.

I-17 also suggests that innovation is different in the food sector from that in FFNHPs because of *"low margins. For most food companies, the focus is on cost reduction*

rather than entirely new products. The food sector in general is so price competitive that to have innovative products, you must go to the second level of innovation which is the higher end, high value products – such as functional foods".

Uniqueness between the two segments of the sector, functional foods and natural health products*:* Three interviewees argued that there is a difference in innovation between the functional food and natural health product segments of the sector based on the level of science, formulations resulting in efficacy and segment activity.

I-9 believes that the functional food and food sectors are similar in their approach to innovation. He argues that they are both *"very conservative"* in their approach and focus on protection of their brands. The NHP sector in Canada in his view "*is based in science and therefore is very innovative".*

While I-12 argued that the NHP segment should not be considered innovative, she believes the functional food segment *"could be"* innovative. She argued that the manner in which functional ingredients are incorporated into food and the quantity incorporated could be innovations *"but currently, they just don't have an understanding on how to do it".* With respect to the dosage amount, she suggested that until a therapeutic measure of an ingredient is included in a food, then that food should not be considered an innovation. She also gave an example of a flawed effort to incorporate a functional ingredient into a product. She offered that when omega-3 was incorporated into orange juice, they found that the ingredient was being absorbed into the carton. She concluded that *"for functional food, innovation is about protecting the enzymes and having them in dosages that are therapeutic".*

The functional food segment is "*far more innovative than the NHP segment"* as argued by I-20. Her argument is based on the increased activity her company has seen regarding novel ingredients such as beta glucans that are being incorporated into food products. These novel ingredients target specific conditions such as metabolic syndrome and therefore offer significant innovative formulation requirements in a food product that will be accepted by the consumers (in reference to taste and texture).

Expected outcomes of the sector

I-3 and I-19 observed that the expected outcome of the FFNHP sector in general, not just Canada, focuses on pathways in which nutritive components can assist in reducing health care costs and postponing health treatments and thus costs into the later stages of life. They argue that the expected outcome requires innovative approaches to nutrition and therefore makes innovation in this sector unique.

I-7 however argues that the expectations of the sector are not appropriate. *"In North America, we are too focused on trying to find the magic bullet solution. There are too many expectations of FFNHPs … they can't make us healthy and that's what the difference is with technologies like the iPod. The iPod delivers our music in a different way but we expect NHPs or functional foods to make us healthy. Consumers don't understand that it is only one part of healthy living. The expectations are way out of line".*

Competitive advantage

Two interviewees identified patents giving their company a competitive advantage as a rationale for why they considered their own company to be innovative.

I-4 stated that he did not know enough about the sector as a whole to comment on whether or not it can be perceived to be innovative. He did however argue that his company is innovative because of the patented technology his company has developed. The patents provide the company with a competitive advantage in the marketplace. This rationale is consistent with his perception of linking intellectual property rights with innovation. I-5 supports this view in his rationale.

Challenges/barriers

Interviewees cited many challenges or barriers to innovation in the FFNHP sector when responding to the question of whether the FFNHP sector is innovative. The challenges or barriers were noted as: lack of an industry; lack of scientific expertise; lack of research and development (R&D) capacity; public policy; lack of collaboration, consumer expectations; tolerance for risk; lack of creativity.

At the outset of the question, I-6 challenged the premise that a FFNHP industry or sector and a food sector as well actually exists in Canada. She argues that while *"there are a number of food and FFNHP companies in Canada, there aren't enough of them to be considered an industry. With the exception of Canada Bread"*, she

maintains that there are too few companies in the country that are large enough *"to make innovation pay".*

I-6 maintains that the MNEs have wakened to the concept of health and thus captured that market. She observed that *"we don't have enough of a core industry in Canada to be innovative. Innovation comes from the States* [United States] *because that's where the headquarters of these companies are and that's where their scientists are".* She continued that "*the biggest challenge in Canada for the sector is the lack of scientific know-how. We can't find the scientists".*

She explained that her company could not find the scientific expertise in Canada it required and therefore looked for it in other countries. She also argued that *"the cost of scientific and development assistance in Canada is double that of the assistance in the U.S. The Scientific Research and Experimental Development (SR&ED) tax credits offered in Canada are not applicable if contracting that assistance outside of the country".*

I-7 supports this view and notes that research collaboration between regions is required for innovation to flourish. She contends that Canadian researchers are unaware of the needs of the big food companies and their consumers. *"They are just chasing grant dollars … all they want to do is fund themselves and their post docs for another year or two".*

I-18 who believes this sector is innovative suggests that while his company does not have the scientific capacity in-house, access to National Sciences and Engineering Research Council (NSERC) of Canada grants allows his company to sub contract necessary expertise.

While I-7 and I-6 believe that we lack sufficient capacity in research and development, four FFNHP interviewees (I-12, I-14, I-16, I-23) offered that the sector contains a wealth of exactly the opposite – *"a bunch of charlatans"; "crooks"; "pseudo science"; "pseudo innovations and innovators", "snake oil"* – which acts as a barrier to true innovation. They all argued that the public is being manipulated to believe *"innovative marketing claims"* which are not founded in sound science. Note however, that none of the four apply these attributes to their own companies but rather to the sector as a whole. Interestingly, these interviewees noted that their companies follow the pharmaceutical model of scientific proof and clinical trials.

Another challenge was raised by I-1, I-12, I-5, I-7 and I-15. They argue that the biggest challenge and differentiator is the current regulatory environment that does not allow a company to identify the key selling features or the key consumer benefits (or at least in only a very few cases). I-1 stated that *"the regulatory environment is stifling innovation".*

I-15 used surprisingly similar verbiage and stated that *"the unintended consequence of the regulatory process and the work of the NHPD* [Health Canada's Natural Health Products Directorate] *truly stifles innovation".* She added that the regulatory system requires all products be tested in Canada but that the country lacks the capacity to do so. She fears that another unintended consequence will be the demise of SMEs in the Canadian sector. She argues that only the large companies will be able to survive the process required by Health Canada.

I-12 noted that the *"strength and power of Health Canada and its employees is disheartening to true innovators"*. She claims that the agency and its employees are not open to innovation and have cautioned too heavily on the side of risk aversion at the cost of providing benefit to public.

Even interviewees who believe that some innovation does occur in the sector spoke of the impact of the Canadian regulatory environment as an impediment to innovation. I-5, although providing a qualified affirmation of innovation in the Canadian sector, later in the interview stated *"that there is no real place for innovation in this industry because of the regulatory environment in Canada … and innovation will not flourish in the sector until the mindset of Health Canada changes".* When asked to clarify his remarks, he argued that Health Canada focuses its attention on treatment rather than prevention. He also argued that Health Canada provides *"only minimal resources to the appropriate departments, the Food Bureau and Natural Products' Directorate. The result is administrative delays in the approval process that are lengthy and ending in missed opportunities for the applicants".*

I-7 supports this view. She claims, and supported by I-15, that the Canadian FFNHP sector was once considered to be innovative *"but not anymore".* She continued that before the regulatory process was introduced, companies were free to investigate new materials. These did not require standards of evidence. She argues the *"we* [the Canadian industry] *were on the map internationally with new materials … but*

innovation has changed. It is much harder to innovate as all anyone is focused on is the regulations. *The spirit of the regulations was meant to protect standards. And they have just inhibited all the good work that Canada was doing".*

I-9 interprets the current Canadian regulatory environment somewhat differently and believes that a regulatory system *"is a balancing act"*. While he acknowledged that it can hinder innovation, he also suggested that *"it can enable innovation by requiring more scientific studies which are the foundation of innovation".* He noted that the level of innovation in an industry is a function of the amount of research being conducted. Note that I-9 defines innovation through the perspective of outcomes, research and patents.

Some positive inclinations concerning the regulatory environment in Canada were also presented by I-20. She noted that the stronger regulations *"will weed out the snake oil".* But she also observed that the level of proof required by the regulations is beyond what is currently available. She argued therefore that the regulations severely curtail innovation adding that *"slim pickings just got a whole lot slimmer".*

Another impediment to innovation noted is the size of company involved in the Canadian sector. I-1 noted that *"they are usually SMEs who need to leverage their transformational innovation through incremental innovation to bring in much needed cash … so they aren't focusing on the more important transformational innovation"*. I-5 however believes that innovation occurs at the SME level.

Tolerance for risk was also identified as a barrier to innovation. 1-9 argued that Canadians in general have a low tolerance for risk which in his view is a major barrier to innovation. He stated that *"we just don't take risks and therefore we don't reap the benefits like the Americans do".*

Finally, creativity – or the lack of it – was identified as a barrier to innovation in both the food and the FFNHP sectors. I-16 stated that the *"lack of scientific creativity is inhibiting innovation"*. He argued that for innovation to occur, scientists, whether public or private, must be allowed freedom to be creative.

I-17 supports this view of a lack of creativity particularly in the food and the functional food sectors. He argues that *"innovation is often left to the R&D teams which are comprised of food scientists. Unfortunately food scientists don't use the 'left brain'.*

They are trained to be too technical and too much about process". He expressed considerable concern that the university system in the country does not focus sufficiently on enabling the development of the creative process in its students. He argued that *"creativity is the very foundation of innovation".*

4.2.2 Sector innovation – actor group: food sector

None of the nine food and retail interviewees believe the food or FFNHP sectors to be innovative. Since these interviewees believe that the food company strategies focus on health, they do not differentiate between food and FFNHP sectors. As I-21 noted "*the difference between innovation in the food industry and the FFNHP industry is just one of degree. There really is no difference in the end message. The product still must have quality and be safe."* I-25 agreed somewhat and stated that the FFNHP however *"is putting the science back into food".*

Three of the nine food/retail interviewees (I-2, I-22, I-25) however believe there is some innovation occurring in the food and FFNHP sector while an additional one interviewee (I-10) stated that he does not know if the industry is innovative or not.

While talk of innovation is rife in the sector, in general the interviewees do not believe the sectors are innovative. I-24 eloquently summarized the point by stating that in the food sector *"there is a lot of activity in terms of things that people are doing that really aren't related to anything. There are lots of really cool power point decks that are developed to explain a strategy that has been developed. But does anything get translated into innovation? No."*

I-13 provided the rationale for his negative response. He argues that the large food companies use the terminology innovation *"to reassure policy-makers that they are addressing societal concerns"* and that the SMEs *"think they are offering innovative solutions … but it's all just cloak and mirrors in an attempt to get government support".*

These interviewees provided rationale for their belief that the food and FFNHP sectors are not generally innovative based on uniqueness and challenges or barriers to innovation.

Uniqueness

Three interviewees, I-11, I-13 and I-25, differentiated between the food industry and other sectors in the area of innovation. Differing from the observations of the FFNHP interviewees, I-11 and I-25 compared innovation in the food and FFNHP to the food sector's enabling industries such as the packaging, equipment, technology and input sectors. Clearly they differentiate food for human consumption from other parts of the demand network.

With respect to the input sector, I-11 argued *"food is food and that isn't going to change so innovation in the food sector therefore doesn't occur".* He distinguishes between food and agricultural or biological inputs. He argues that *"innovation occurs in the genetic modification of plants which is real innovation".* This is consistent with his concept of innovation as an outcome or process. He gave the example of genetic modification resulting in canola crops that do not require or require minimal usage of pesticides. *"It's just so wonderful to walk through fields of canola and not smell pesticides"*. To take his point one step further concerning innovation through genetic modification, he questioned whether the traditional method of plant breeding could be considered innovation or *"just good luck … are some of the directions in plant breeding just happening because a breeder recognizes something that happened three hundred years ago?"* He argued therefore that while plant breeding is not considered innovation, genetic modification is. This example also demonstrates his other point. Innovation, I-11 argues, has been *"focused at the production level* [i.e. on the farm] *to bolster quantity and transportation as inputs into food. Innovation has not focused on providing benefit in the form of nutritional benefit".*

I-11 provided another distinction between innovation in food and innovation in the enabling industries. He agrees that Campbell's ready-to-eat (RTE) soups are innovative because they provide consumers with the benefit of convenience. The package itself is the heat receptacle rather than requiring a pot to heat the soup. He argued however that it is not the soup – the actual food portion of the product – that is the innovation but rather the packaging. *"It's a clever adaptation of a deliverable technology. But that's not innovation in food".*

I-25 concurred although in a roundabout manner. He first began by observing that the current focus of the food and the FFNHP sectors is the provision of healthy nutrients to the end users. As he progressed in his rationale however, he argued that *"the food itself is not the innovation, but the technology or equipment that is used in*

the food processing that is the innovation. The food item is still food". He gave the example of a new technology that provides an economic extraction of water (i.e. a new drying technology) from a biological source. He demonstrated his point by showing a very thin slice of potato that had been dried (extraction of ninety-eight percent of the water) using this new technology. This new technology allowed for the potato's nutrients to be maintained and at a significant cost reduction to freeze drying. He then stated: *"so it's the process – the technology – that is innovative, not the potato".*

I-13 supported the notion that innovation occurs in the development of new equipment that allows for line extensions of new food items. He gave the example of new packaging technology that allows for shelf life extension of highly perishable items such as meat and produce. *"The equipment manufacturers are the innovators and the food companies just apply the technology".*

I-22 differed from the other interviewees in distinguishing between food and its enabling industries. He clearly recognizes technology and equipment to be part of the food system. While he does not believe the sector is innovative, he believes *"there are some interesting innovations happening".* He provided the example of high pressure sterilization in the food sector. He believes it to be *"very transformative in the food industry".* This type of technology for example allows oysters to be treated so that they are safe but can still be consumed raw by consumers.

Challenges/barriers to innovation

I-2, I-10, I-24 and R-1 identified challenges or barriers to innovation as their rationale for their lack of affirmative support for labelling the food and/or the FFNHP sector as innovative. These interviewees provided challenges or barriers in three categories: company size; corporate culture; and the government.

I-2 and I-24 discussed the challenge of company size. Both had agreed that the sectors could not be considered innovative. They both discussed innovation from the perspective of large and multinational companies and then SMEs. I-2 observed that from a large company perspective, *"it's only recently, in the last five years, these companies in general have formalized the concept of innovation into their strategies either by elevating someone to the position of Vice-President or Director of Innovation".* Some companies have gone so far as to establish their own food

innovation centres. But he argues that the formalization of these concepts is new *"and it still doesn't make them innovative"*.

Both I-2 and I-24 suggested that only large companies have the resources, *"the deep pockets"* required to focus on innovation. SMEs lack the necessary resources. While I-24 acknowledged that SMEs *"are as innovative as they can be … they really aren't. The best place for innovation is in the big companies because they have the resources to commit to it."* Even the large companies however limit their spending. I-2 stated that *"large food companies can afford to work on only a few innovations at a time because of limited resources".*

In their view, the challenge faced by the large companies is the need to protect the company brand. While brands must provide a point of differentiation, I-2 and I-24 argue that the risk of failure and harm to the brand makes large companies more risk averse and therefore inhibits innovation. I-24 expressed the point by stating *"large food companies receive a 'C-' when it comes to innovation. They aren't prepared to take risk … the risk of failure is high and so feared. All it takes is one event that fails and from then on, innovation is very limited".* Both interviewees argued that consumers are much less forgiving of food companies than they are for other industries that *"flub up"* as I-2 expressed providing the example of the failure of New Coke to capture a market.

I-2 added that *"it's not only consumers who remember the new product failures of the large companies but also the internal investors".* He argued therefore that while large companies have the resources for innovation that SMEs do not, larger companies *"must be much more vigilant in bringing new products to the market".* Note that he was the only food sector interviewee that did not express the concept of innovation in the form of an outcome but rather as a process.

The second challenge or barrier to innovation identified was corporate culture. I-10 who expressed no knowledge of the rest of the sector, stated that while he considers his company to innovative, it is a result of the corporate culture he has built within the company. Based on the feedback he has received from his employees who have worked at other companies, he questions whether the appropriate culture is nurtured in the sector. He says that his *"company's success has been built on the Toyota model focusing on lean manufacturing and about removing barriers to getting a job*

done … about developing a culture of fun and innovation" that is inclusive of all employees.

I-24 concurred with this point and stated that the *"biggest barrier to innovation is a culture that says it accepts failure but it really doesn't … for innovation to occur, employees must not fear reprisals if ideas or new products fail".* He continued *"… lots of companies SAY* [his emphasis] *they want risk and will enable innovation but when the group fails, they are all penalized. It may not happen immediately, but somewhere down the line, the team and particularly the team leader will be penalized".*

The final barrier to innovation identified was that of *"government interference"* in Canada. While R-1 noted that many industries are highly regulated, he argues that Health Canada has *"lost sight of balancing the benefits to the consumers"* of new and innovative functional food and natural health products *"with bureaucracy".* He argued that the *"government is too risk averse and consumers are not receiving the potential health benefits they could be receiving. Government interference"* in his view is inhibiting innovation.

4.2.3 Sector innovation – actor group: research/academia

Of the six researcher/academics interviewed, only A-6 provided an affirmative response, albeit qualified, to whether the FFNHP sector is innovative; one (A-6) categorically stated that it is not innovative; three (A1, A-2, A-3) believe that the sector is not innovative but that some innovation is occurring; and finally one (A-3) does not know if the sector is innovative or not.

A-2 argued that *"the Canadian food sector is not innovative and that the Canadian functional food and natural health product sector is really too small at this time to say that it is innovative*". He believes however that some innovation is happening in the sector. *"Innovation is coming from the small companies and some companies have done some good things. For example, the introduction of flax into a chicken's diet resulting in an Omega-3 egg that provides a health benefit to the consumer without the necessity of taking a supplement. The cost adds only 3 cents to a dozen eggs".*

A-2 also argued however that the FFNHP sector is a good example of a lack of knowledge about the concept of innovation, as well as the sector itself. He stated

that *"if you don't understand innovation as well as the sector, then it's very difficult to develop and adopt institutional change".*

A-5 believes that innovation in the food and functional food sectors does not occur. She was the most firm in her stance by responding immediately *"absolutely not".*

The research/academic actor group provided rationale for their responses regarding innovativeness in the sector, or lack of it, in two broad categories: uniqueness and challenges or barriers to innovation.

Uniqueness

Uniqueness from other industries: A-1, A-4 and A-5 believe that innovation in the food and nutrition sector is different than other industries. A-4 and A-5 both stated that *"food is personal"*, much more personal than other products found in other sectors. A-4 continued that *"food is sacred. You can't play around with it".* A-5 supported this notion by stating the *"the food industry is very traditional. Consumers are not very happy when the food companies play around with their food and the taste of it".* These interviewees believe the implication is that the food and functional food sectors focus on incremental innovation rather than transformative that might be found in other industries such as information technology.

A-2 offered his rationale for supporting the view that while the FFNHP sector cannot be considered innovative, there is some innovation occurring. He argued that this sector, *"health and agriculture",* is unique from innovation in other sectors such as communications' technology *"and particularly in Canada for three reasons: 1) health insurance; 2) involvement of "living beings"; and 3) role of government and producer organizations in agriculture".*

Canada enjoys a health care system that is available to all its citizens. A-2 argues that the implication of the health insurance system in Canada *"changes individual and private incentives massively and changes private consumption".* He continued that such a global system available to the public *"results in innovation targeting treatment rather than prevention which impacts innovation in food and health … if we didn't have health insurance, we would see far more innovation"* focused at prevention. The consequence is, in his view, that the *"private market is highly distorted because of health insurance".* Any innovation that occurs on the

prevention side benefits primarily the public. And since *"companies innovate to receive private benefit"* the current system A-2 argues is "*a disincentive to innovate"*.

A-2's second argument regarding the uniqueness of this sector to other industries involves the life sciences' sector as a whole. The life sciences sector he argues involves the study and application of *"living beings"* or organisms. He argued that *"we, the public, have a sense of what is natural and what is manmade* [sic]*. Because we are dealing with living beings there is a cultural and theological interchange that is not present in innovation in other parts of the economy but is in the life sciences".*

Finally, A-2 argued that the involvement of producer organizations is far greater *"in all parts of agriculture which is the source of the functional food and natural health products industry"* than other industries in Canada. He continued that the *"country's producer organizations hold a strong view of plant breeders' and indigenous rights which inhibits innovation".* He argued that companies have difficulty capturing value due to the strength of the producer groups.

Uniqueness from food: A-1 suggested that *"innovation in the food industry involves processes and formulations"* while in the FFNHP sector, innovation involves understanding functionality, *"it's as simple as knowing exactly what's in a blueberry"*. His rationale is consistent with his belief that innovation is about discovery.

Challenges/Barriers

A-1, A-2, A-4, A-5 identified the following challenges or barriers to innovation in the food and FFNHP sector: low margins; consumer behaviour; the regulatory environment; and Canadian culture.

A-1, A-4 and A-5 argued that innovation in food and FFNHP is limited due to the small financial margins realized by the industry. Companies are therefore not prepared to undertake transformative innovation due to a perceived higher risk of low returns on their investment. As a consequence, research at universities is impacted. A-1 argued that the levels of return on investment in innovation is often much higher in other industries. "*The food industry isn't a RIM … the payoffs just aren't there in the food and health sector".* RIM is the Canadian company Research In Motion, the globally successful company that developed the Blackberry, a wireless communications' tool. A-1 continued that because the returns in *"the food and nutrition sector"* cannot compare to innovations in other industries, *"support in the*

form in research infrastructure and funding – we desperately need new labs – is not available. We're lucky if we get any assistance at all".

Another interviewee, A-6, commented on the investment in research in food and health but compared it to investment in the U.S. rather than other industries. He argued that unlike Canadian academics and researchers, American universities encourage new ventures and spin-off companies which he contends are large sources of innovation in the food and health sector. As well, he contends that the U.S. Department of Defence (DOD) *"spends far more money than we know about on food and health. National Defence has far more money than the National Institutes of Health and the USDA. My colleagues down south can get all sorts of funding from the DOD. We just don't have those sources".*

Consumer behaviour was also identified as a challenge to innovation. A-1 argued that consumer behaviour is an impediment to innovation in the food sector which is consistent with A-4's comment: *"food is sacred; you can't play around with it".* A-1 argued that while consumers say they are looking for new products and healthier options, their actions demonstrate the opposite. He gave the example of McDonald's. When asked, *"customers stated that they want healthier options and indicated they would prefer a hamburger with a whole wheat bun rather than the traditional white bun. When the option was actually given however, customers overwhelmingly chose the white bun".* While the introduction of a whole wheat bun could be questioned as to whether it met the criteria as an innovation, the point made was that consumer behaviour often inhibits innovation.

A-2, A-4 and A-6 believe that the current regulatory environment in Canada inhibits innovation. A-2 stated that it *"is a drag on innovation … it's a disincentive to innovate because the cost of innovation is so high on the innovator".* He argued that the regulations favour the public good rather than private good or incentive. He gave the example of *"the omega-3 industry that struggled for ten years to get approval to put something on the label and then the new companies can take advantage of that success … it then becomes a public good and there is no competitive advantage for companies in the sector".*

A-4 was somewhat more forceful with respect to the Canadian government's regulatory oversight of the sector. *"How many battles can you expect to win? This*

sector needs to know how many battles to take on. And for an emerging sector, it's pretty tough".

The Canadian regulatory environment, in A-6's view, has forced this country's innovation in FFNHP to lag behind that of other countries such as Japan and the United States. He stated that the regulations known as DSHEA in the U.S, are *"more codified"* and allow companies *"to be really creative at writing their promotional materials"* thus enticing innovation in that country.

A-4, A-5 and A-6 argued that innovation is a challenge in Canada due to the Canadian culture of inaction and risk aversion. A-4 observed that "*Canadians and Canadian companies are very good about spending a lot of time talking about what can be done. We go to workshops and we talk to the government. But we can't really get people to work together. We don't carry through on stuff. We wait around for the government to help us. It's the nature of our country".*

A-6 offered that Canadians' culture of risk aversion has hindered innovation but then noted that given the current economic crisis, *"we are thankful that our banking system has not allowed the risk taking that other countries and banks have allowed. But that culture has held us back from an innovation perspective".*

A-5 agrees that culture is an inhibiting factor in innovation but is not limited to Canada. She argues that the health ingredient sector in general *"tries to be innovative but they are not that successful. They just don't have the intention to innovate".*

4.2.4 Sector innovation – actor group: government

Five of the six government interviewees responded when asked if they believed the FFNHP is innovative. G-1 responded affirmatively while G-6 provided a qualified affirmative response noting that only some companies in the sector are innovative. G-2 and G-4 both responded that the sector is not innovative and G-3 offered that he does not know.

G-2 argued that less than ten percent of the industry can be considered innovative. He argued that the sector in general *"lacks sophistication required for innovation. There are too many traditional products but not very many avant-garde companies"*, companies in his view that could be considered a source of innovation.

G-6 believes that the sector is innovative with some qualifications. She argued that while much of the FFNHP is undertaking *"a lot of crude activities – simple crushing of oil is not innovative"*, the sector is innovative *"because it is changing the way consumers are taking health into their own hands … taking Cold FX to prevent a cold instead of Benedryl to treat the symptoms of a cold".* This rationale is consistent with her concept of innovation that is focused on intangible outcomes – benefits derived.

Rationale for their responses centred on sector uniqueness and challenges/barriers to innovation.

Uniqueness

Unique from other industries: G-2 argued that the FFNHP and indeed the food sectors are unique from other industries due to *"the potential level of harm to the person that could be caused"* by eating or ingesting these products as opposed to other products which are not taken directly into the body. He stated that *"the goal posts for innovation are much narrower when it comes to public safety – and public safety trumps innovation".*

G-4 however noted that uniqueness is not a consideration because regardless of the industry, *"all the principles* [of innovation] *are the same".*

Challenges/barriers to innovation

Four of the five government interviewees responding to this question identified challenges or barriers to innovation as part of their rationale as to why the FFNHP sector is or is not innovative. Categories identified were the complex innovation systems; lack of collaboration; the regulatory environment; lack of capacity to commercialize; and size of market.

G-1 and G-6 believe that the FFNHP sector is innovative (although G-6 qualified her response). Of interest is that G-4 gave the same rationale as G-1 but his conclusion is that the sector is not innovative. Their view is that innovation systems are currently so complex that collaborations are required to achieve innovation. While research has often been conducted in silos at various institutions and by field of study, collaboration will grow increasingly important for innovation to occur in the future.

G-1 used that argument to maintain that collaboration is more likely to occur in larger more established companies who have the capacity to collaborate on a global scale. He argued that *"innovation is more likely to occur in the SMEs"* and therefore they are linked to the larger companies who then collaborate with other regions. G-4 used this argument to state that complexities require collaboration *"and that's just not happening".*

While G-1 maintains that the sector is innovative, he argued that the regulatory environment in Canada impedes innovation. He suggested that the regulatory body has been slow to understand innovation in this sector and therefore continues to support the pharmaceutical model. *"Canada' regulatory system is run by Health Canada and it is not ready to deal with these novel foods. It does not have the capacity to do so. Only the pharma sector knows how to deal with our regulatory process well and so their innovative products get through … in fact, Canada's food system operates under a paternalistic regulatory environment".* The implication of G-1's remarks is that the regulatory system in Canada has not kept pace with innovation and its potential benefits to the public.

G-2 offered observations regarding challenges to innovation. He argued that while innovation (i.e. discovery) is happening in academia, Canada lacks the capacity to commercialize the innovations *"due to a lack of innovative companies in Canada".*

Finally, G-6 suggested that limited markets for benefits derived from innovation offer little incentive to innovate. Her example was the innovation of microencapsulation. That technology is not an end product and *"consumers don't often realize such a technology is incorporated into a product. I don't know about it. I don't see it. But it doesn't mean it doesn't exist".* The benefit to the consumer however is the incorporation of, for example, *"fish oil into a product",* providing the benefit of the inclusion of omega-3. She noted that while significant investment was required to develop the microencapsulation innovation, the market uptake for the technology has been minimal. She argued that *"companies can't afford to invest in innovation if the return on investment is not realized".*

4.2.5 Sector innovation – actor group: non government organization

Two representatives of the NGO actor group were interviewed. While both believe that the FFNHP sector is not innovative, NGO-1 stated that some innovation is occurring. He argued that the FFNHP sector in Canada is *"unique because it's still*

very young. Most of it is just starting. It's where the IT [information technology] *sector was in the 1980s".*

The rationale that these interviewees provided for their responses was viewed through challenges/barriers of innovations: lack of scientific expertise; access to capital; the regulatory environment; Canadian culture; and public policy.

Challenges/barriers to innovation

While NGO-1 argued that the sector as a whole cannot be considered innovative, some segments of it are. For example, he identified that the Canadian FFNHP sector "*is very innovative in the area of omega-3 fatty acids … and probiotics"*. With respect to probiotics, he referred to *"the extensive research conducted at INAF".* He continued that the barrier is the lack of scientific expertise activity in general that is inhibiting innovation in the sector. He observed however that *"the sector is coming into an interesting phase due to the emerging science in nutrition".* The new science he argues will lead to more interest in the area and thus more science which will result in more innovation.

Both NGO interviewees argued that the current regulatory environment inhibits investment in the sector and thus innovation. NGO-2 believes that while the sector is not innovative at this time, *"there's enough scientific evidence to demonstrate that it can be a tool for a healthy Canada"* but the regulatory environment inhibits attraction of sufficient financing of scientific investigation. NGO-1 concurs and believes the lack of financing is slowing innovation. He stated that *"the sector spends less than half a percent of revenues on research and development as opposed to the pharmaceutical sector that spends closer to twenty percent".*

Canadian culture was also identified as a barrier to innovation. NGO-1 believes that the Canadian FFNHP sector is filled with *"no shortage of ideas and expertise .. but in the end, Canada's culture with respect to failure will hold the sector back. We are not risk takers."* He likened the situation to that of our American neighbours. He observed that unlike Americans who continue to take risk even after failure, *"Canadians just won't try again".*

Finally, NGO-2 identified public policy as a limiting factor to innovation. He noted that current public policy requires value to be realized at the farm level for any public investment in innovation related to food, including the FFNHP sector. While he

acknowledged that *"farmers themselves are very innovative and therefore a good model",* functional ingredients often require such small quantities of primary agricultural materials that government may not see the value returning to the farm if investment is made in FFNHPs. Public policy could then dictate that investment is placed in other sectors, limiting potential in FFNHP innovation.

4.3 Conclusion

This chapter examined the field work with respect to the first research question: How is innovation defined and approached in two segments of Canada's food system: food manufacturing and functional food and natural health products?

The research demonstrated that the interviewees generally struggled with articulating their understanding of the concept of innovation therefore leading to the conclusion that it is not well defined. As well, in most instances, their understanding was multi-dimensional, that is encompassing more than one concise meaning.

The most common theme among the interviewees in the various actor groups was that innovation is equated to value and value is equated to economic benefit. The meanings included tangible and intangible outcomes, discovery, process, systems and various characteristics. Of particular interest is the final point, characteristics. Although support was strongest from industry interviewees, the human element, characteristics of the innovator, were equated with the definition of innovation itself.

A good example of the differing views of innovation is related to the iPod. Interviewees saw the same outcome, the iPod itself, but identified innovation as it relates to the iPod differently. It was expressed in terms of a new product; as an intangible benefit; as the technology behind it; as the change that occurred in how consumers view and access music; as the innovator's mindset (the ability to envision a new application by connecting available technologies); and as consumer insight.

A second conclusion flowing from the interviewees with respect to the first research question is that the FFNHP sector is not innovative as a sector. Innovation is happening within specific companies such as Afexa Life Sciences and Ocean Nutrition Canada or in people such as Yves Potvin, President of Garden Protein International. The implication may be that it is too early in the sector's lifespan; the sector lacks sophistication; or there are specific challenges facing the entire sector which prevent it from being considered innovative. In this instance, the research

indicates that across all actor groups, Canada's regulatory environment is seen as the major drag on innovation.

The research also indicates that there appears to be a blurring between food and FFNHP sectors. The food sector now looks at itself within the context of health and therefore is linked closely with the FFNHP sector. The difference in innovation therefore may be one of degree. While the food sector is larger and generally has more resources available for innovative activities, companies are more likely to undertake incremental innovation to protect their brands.

In addition, there was discussion as to what comprises the food sector. The findings of the research indicate that innovation is more likely to happen within the enabling industry such as packaging, equipment and food safety. Innovation in FFNHP is more focused on the product itself such as formulations, bioavailability and standardization.

A third conclusion is that innovation in FFNHP and food is different than in other industries. It may however be more a matter of degree rather than actual differences. While radical innovation is expected in other industries, generally the interviewees believe that consumers view food, including FFNHP as sacred and therefore are less inclined to accept radical change in what they consume. The sacredness is derived from an emotional, cultural and religious attachment to food not seen in other industries.

In addition, the strength of producer organizations was raised as a differentiator affecting innovation not seen in other industries. Producer organizations in Canada have lobbying capabilities and demonstrated strength in securing public funds targeting innovation at agriculture rather than food.

The other major drags on innovation in the Canadian sector raised were: the lack of risk tolerance within public policy and at the company level; lack of scientific capacity; and lack of collaboration.

The final conclusion is that the first research question unveiled the beginning of tensions within and among actor groups. The tensions surrounded not only the definition of innovation, but the challenges faced by the sector. Collaboration is seen as being forced due to convergence of sciences and public policy. The regulatory

environment is causing tensions due to the high cost of innovation resulting from the regulations. These high costs however do not translate into higher margins in the marketplace.

CHAPTER FIVE – Interviewee perceptions: Drivers and measurements of innovation in the food system

5.0 INTRODUCTION

Chapter Five reviews the findings of the research questions two and three, examining the drivers and measurements of innovation in the Canadian sectors under examination. Both areas are examined from the perspective of the various actor groups. The findings of the research resulted in four core arguments.

The first argument is that if innovation is happening in the FFNHP and food sectors, it is likely incremental innovation. The results indicate that activity in Canada is better described as commercialization rather than innovation. The linkage between commercialization and the number of new products or economic outcomes may be one measure of innovation but not all new products can be classified as innovative. As well, there was no connection linking measures of innovation with significant change.

A second core argument is that government innovation policies and programs may be counterproductive. Government policy with respect to the regulatory environment is perceived to be a drag on innovation. Government and government policy however is perceived to be a key driver of innovation. This conclusion indicates that government departments may be working at odds with each other regarding innovation.

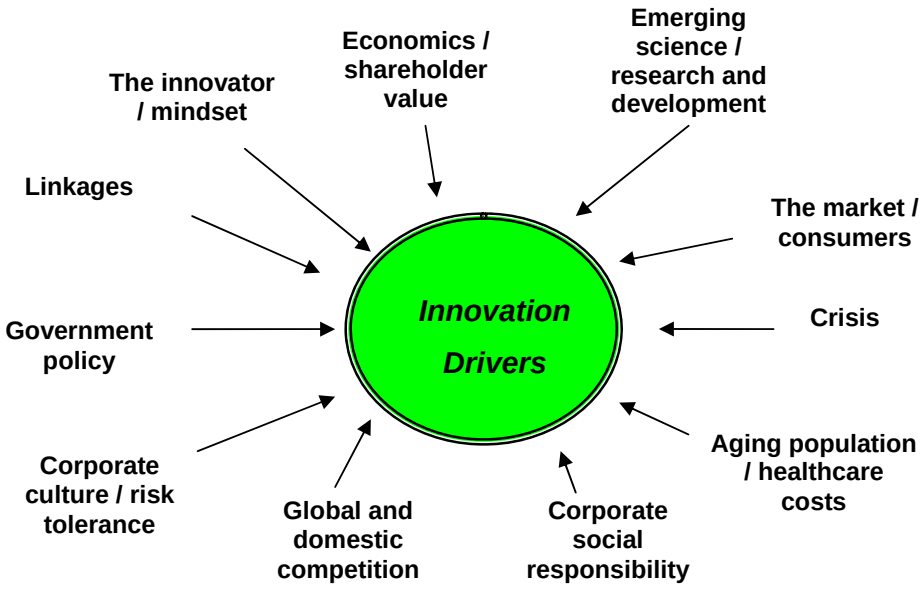
Another key finding of this chapter is consistent with the findings of the previous chapter in that tensions exist within actor groups of innovation. Government and academic actors are the least likely to have innovation goals or objectives in their organizations or departments. While these actors see themselves as playing an integral role in innovation in Canada, they are clearly struggling within their own organizations regarding the concept of innovation, their role in it and how it can be measured.

And finally, this chapter supports the findings of the previous chapter that innovation is complex. As a result, the final core argument is that Canadian innovation and Canadian actors' roles in innovation will become even more difficult to measure in the future due to the increasing number of domestic and international linkages.

5.1 Drivers of Innovation

Figure 27 below provides an overview of the combined views of the interviewees with respect to the drivers of innovation. The interviewees had no difficulty in identifying drivers regardless of their struggles in describing the concept of innovation.

Figure 27: Drivers of innovation

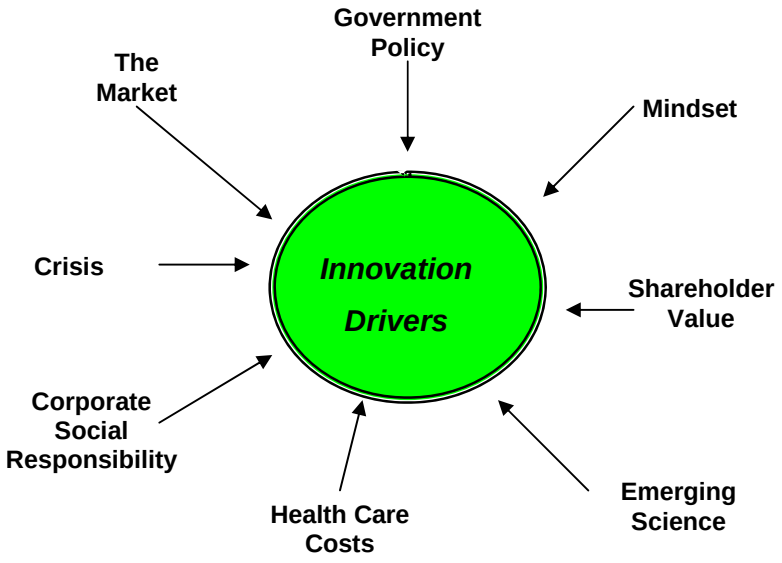


The following section provides a more detailed review of the findings of drivers of innovation as described by each actor group.

5.1.1 Innovation drivers – actor group: functional food and natural health product sector

Seventeen FFNHP interviewees discussed multiple drivers of innovation. In descending order of support, the drivers identified were in the following general areas: the market; government policy; mindset; shareholder value; emerging science; health care costs; corporate social responsibility; and crisis. They are depicted in Figure 28 below.

Figure 28: Key drivers of innovation - actor group FFNHP



Each driver is explained below.

The market

Nine FFNHP interviewees (I-1, I-3, I-5, I-8, I-14, I-18, I-19, I-20, I-23) identified the market as the key driver of innovation.

These interviewees focused on growing consumer demands for new products that offer new or different specific benefits or as I-1 described *"key selling features".* I-1 referred back to his *"product development pyramid"* as outlined in Figure 33, page 253 to demonstrate the point. Consumer demand is the base of the pyramid. He argued that *"the recognizable customer or consumer benefit demanded by the market drives innovation … innovation has to be driven by the customer … or it won't be successful".*

Although not as artistic as I-1, the other interviewees describing the driver as the market, concurred. The key benefits sought however varied. I-1 offered that his market is driving innovation in the area of *"environmentally-friendly products, safe food products and products that offer improved performance".*

Other benefits sought by consumers that are driving innovation were identified as well. I-20 and I-23 identified the needs of an aging population in Canada and indeed

other western countries. This market segment is demanding products that will assist them to stay healthy, mobile and independent into old age. I-20 continued that consumers wish to *"manage their own health care at a time when there is an increasing incidence of chronic disease … and the side effects of drugs that treat these diseases are driving consumers to look at options".*

I-23 offered a different view on benefits sought by consumers. She argues that the market segment comprised of *"the early adopters, the group demanding change for change sake is growing and driving innovation".* It is not so much the specific benefit of a new innovative product she argued but rather the benefit of a thrill to be first to receive the benefit before others. *"They* [early adopters] *are no longer a small niche"* she explained. This segment's *"need to be first for anything appears to be transcending everything".* She offered the example of the *"huge demand"* at the launch of the iPhone in 2007 even though the cost for it was substantial.

I-5 offered a more philosophic view than the others. He stated that consumers demand new products that meet four basic needs: food, shelter, clothing and entertainment. Interestingly, he argued at length that *"entertainment has become a basic need for the developed economies of the world and it's what is driving innovation".* When asked to define entertainment, he noted that it is personal and could include any form from *"training for a triathlon to volunteerism to various forms of work … work is an edgier form of entertainment … our society as a whole has not yet come to the realization that work can be fun and it satisfies a basic need of entertainment not just self-actualization".*

Government policy

Seven FFNHP interviewees (I-3, I-7, I-9, I-14, I-17, I-18, I-19) identified areas relating to government policy as the second key driver of innovation. The sub segments of government policy identified were: regulations; evidence-based policy-making; programs; and taxation.

Three of the seventeen FFNHP interviewees (I-9, I-14, I-18) identified the regulatory environment in Canada as a driver of innovation. I-18 believes that regulations in all countries have driven innovation but his examples were in ensuring a safe food supply. The regulatory environment in his view has spawned innovative programs such as the Hazard Analysis and Critical Control Point (HACCP) system, the development of various standards such as those that regulate the organic sector and

new technology resulting in equipment that ensures or limits the amount of bacteria entering the food system.

I-9 also argues that the regulatory environment spawns innovation in that the current regulatory environment for NHPs in Canada forces companies to provide evidence that the ingredient or product will do what it claims. He provided that observation based on his perception that innovation is about discovery. I-9 argues therefore that a regulatory environment that drives discovery is positive.

While he does not believe the FFNHP sector in Canada to be innovative, I-14 claims that the increased regulatory pressures have been "*one of the great drivers of innovation in the industry".* He explained that the regulations have increased the quality of the products produced and *"forced companies who can't meet the regulations to fail … and that's a good thing … The impact however is likely that many SMEs will not be able to prove efficacy and will not survive".* He explained further that the regulations themselves are appropriate but *"they* [Health Canada] *just aren't handling the process very well".* In other words he stated that the regulations are good but Health Canada's process for implementing the regulations and the approval process was a drag on innovation.

Four interviewees (I-7, I-15, I-18 and I-23) contradicted this argument by stating that rather than forcing innovation, government through its regulations is inhibiting it. I-18, a former vice-president of a company developing ingredients for FFNHP and pharmaceutical companies and now president of a functional ingredient company stated that *"the regulatory environment in Canada provides no motivation for innovation let alone forcing it. It's only inhibiting it. The NHP regs* [regulations] *are too restrictive and the functional food regs essentially don't exist. So what's the motivation to do anything in Canada?"*

I-15 supported this view and when asked if the sector was being forced to innovate, she responded, *"the question is better asked about what is inhibiting innovation and that is the government with its regulations".*

A corollary of the regulatory environment as a driver of innovation is the demand put on ingredient suppliers by the large and multinational enterprises. I-14 observed that the fear of regulators forcing a product to be pulled from the market due to unsubstantiated claims is forcing the new products to provide the *"evidence of the*

innovation … that it does what it says … and they may even not ever use the information in their marketing. But they need it in case the government does the check. They need reputable material".

I-3 and I-17 identified evidence-based policy-making as a driver of innovation. With respect to Canada however, both interviewees used the word *"could"* act as a driver. I-3 offered the first example. He noted that the European Union (EU) has developed policies based on evidence relating to obesity. He explained that the policies developed followed a political route but was based on evidence. In this instance *"the government strongly suggested to the food industry to decrease salt, trans fat, fat in food formulations. The government asks the food industry to do it voluntarily and then does a PR* [public relations] *job on the public … The public then becomes the vocal watchdogs. But at some point, when the majority are on side, the voluntary becomes mandatory and government policy is set".* Government policy or the threat of it therefore becomes the key driver of innovation.

I-17 offered an example of government policy driving innovation from the other side of the Pacific Ocean. He gave the example of Japan and its aging population. His understanding is that government policy based on scientific evidence is targeting people over forty years of age. His understanding is that a baseline measure will be taken of the metabolism of each person in the age group. *"If it is high, and the patient doesn't follow the doctor's orders and it does not come down within a given period of time, then the person's health insurance will increase".* Not only does he believe this approach to be innovative in policy-making, he also argues that this government policy will drive innovation in therapy options.

Government programs developed based on policies were also identified as a driver of innovation in Canada. I-7, the Human Health Director of a functional food enterprise stated that without government funding, innovation would not occur. *"If the government fund was not available, then our organization would not be here and doing the work we are doing. We've been able to establish collaborations of wonderful scientific minds to help us with innovation – all because of government funds".*

Another government program was identified. I-19, President of a technology based NHP company, believes that Scientific Research and Experimental Development (SR&ED) tax credits offered in Canada drive innovation. As the president of a

technology based NHP company which is a university spin-off, she stated that *"government tax incentives are also driving innovation. It certainly has for our company. The SR&ED tax credit provides a cash flow for R&D* [research and development] *that allows us to develop new and innovative technologies".*

Mindset

Six FFNHP interviewees (I-6, I-7, I-9, I-14, I-18, I-19) identified the make-up of the innovator or the entrepreneur as a driver of innovation. Of the six, only I-12 and I-17 had described the concept of innovation through the eyes of personal descriptors of the innovator. Regardless, these six interviewees argued that personal drive not only instills innovation and innovative activity in that person but also in others within a company.

Many key words were used to describe the internal drivers of the innovator. They were: *"passion"* (I-7, I-11, I-12, I-19), *"entrepreneurial bent"* (I-6), *"belief in yourself … belief in what you are doing … gut feel"* (I-17), *"curiosity … quest for discovery"* (I-12), and *"creative bent"* (I-16). I-19 summarized his thoughts by arguing *"it's an internal drive … it's about people who won't take no for an answer … it's about passion and drive of the entrepreneur".* I-7 stated that *"innovation takes a champion, it takes passion".*

I-12 referred to her roots as a scientist and gave a personal perspective on innovative drive. She argued that the key driver of innovation *"is curiosity … that's what drives the quest for innovation. It's the quest for discovery – the quest to help – the quest to find a cure… It's about being a believer in what you are doing … A quest for discovery must be in your blood. You must love it because it's hard work. It's never carefree".*

Shareholder value

Five interviewees (I-3, I-6, I-12, I-14, I-23) identified one of the key drivers of innovation as securing shareholder or company value. They see this accomplished by gaining a competitive advantage in the marketplace.

I-3 and I-12 discussed the need to bring economic value back to the company and its shareholders. This requirement in their view is driving innovation. I-3 offered that meeting the demands of the investors for returns on their investment is becoming increasingly difficult due to the relative lower returns in the food and FFNHP

industries as opposed to other industries. He argued that *"investors have a lot of choices these days"* so companies must innovate to secure higher returns. I-12 was very blunt. *"Money makes the world go round – it's* [innovation] *all about the money".*

The other three interviewees (I-6, I-14, I-23) took a different approach but came to the same conclusion regarding the demand for economic returns. They argued that innovation is being driven by an increasingly competitive marketplace demanding products that offer unique benefits. Companies therefore must focus on innovation to secure their competitive positioning which will result in maintaining or increasing revenue for the companies.

I-6 summarized his thoughts by observing that innovation "*sets up barriers to entry against the competition"* which in turn allows the company to realize returns on their investment in innovation. I-14 and I-23 make the same argument regarding revenue protection. In reference to innovation drivers, I-23 argued that *"of course there is always the corporate reason – securing their own competitive positioning to keep or make the company profitable".*

I-3, the president of a company working in the area of medical foods, offered his view that *"the competition is forcing the sector to innovation. There is so much competition that if the sector doesn't continually innovate, then it will fight a commodity war and we just can't win on that count. Look at* [Company X – a Canadian NHP and health ingredient manufacturer]. *They started out as innovators but aren't anymore. And it's now in trouble financially because it's too hard to play the commodity game".*

After expressing that viewpoint, I-3 contradicted himself. He wondered aloud: "*The question is – can you really force innovation? You need power and resources to do it and SMEs just don't have it".*

Emerging science

The emergence of new scientific findings was also noted as an innovation driver by five FFNHP interviewees (I-5, I-9, I-14, I-15, I-23). Of the five, only I-23 had described the concept of innovation in the context of discovery.

I-5 noted that emerging scientific discoveries in other industries such as the pharmaceutical industry are being applied to the FFNHP sector. I-9 simply identified

research. I-14 discussed it in the form *"pursuit of new science or technology"* as a driver of innovation, while I-15 noted that *"emerging science is demanding innovation".* Each of these interviewees described innovation in the form of outcomes. They argued however that emerging science described as *"new knowledge"* by I-23, demands that new products are developed that will reduce the incidence of chronic disease.

I-23 offered a consistent response with her argument that innovation is about discovery. She noted that *"there are lots of ingredients that haven't even been discovered yet"*. This emerging science and the quest for it are in her opinion driving innovation.

Health care costs

Two interviewees (I-4, I-20) identified the rising cost of health care as being a major driver of innovation. I-4 is Chair of the Board of Directors of an NHP company. He identified the health care needs of the aging population in Canada as a growing cost to the nation's health care system. He noted: *"the costs of health care are skyrocketing. Not only are we as a country not going to be able to afford it, but the boomer generation is demanding health prevention so that they can remain active and not let health care costs eat up their savings".*

I-20 supported this view. She added that it is not only the aging population that is driving innovation to address health prevention issues, "*but even the physicians are looking at alternatives to keep their patients healthy longer before starting on the various cocktails of medications older people require to keep them alive".*

Corporate social responsibility

Two interviewees (I-1 and I-23) identified the movement towards corporate social responsibility (CSR) as driving innovation in the FFNHP sector.

Interestingly, the two interviewees approached CSR from polar opposites. I-1 states that innovation is being driven in the sector because *"customers and consumers are demanding corporate social responsibility. They demand that we demonstrate care for the environment. That demand is what is driving innovation. We have to come up with products that are green if we want to stay in business and make money".*

On the contrary, I-23 provided a much more altruistic viewpoint of the CSR driver of innovation. She stated that *"many of the companies in this sector want to improve the health of the world. Many of them are spin-offs and bring the university scientists with them. They aren't in it for the money but to make a difference".*

Government funding

Access to government funding was noted by I-7 and I-9. Both organizations that they represent depend on and have depended on government funding to undertake innovative activities. From that perspective, these two interviewees believe that government funding forces innovation.

I-7 argued that this sector as well as the food companies and agriculture communities in Canada rely on government funding heavily. As such, she argues, government is forcing innovation. She observed, *"well if we don't innovate, we won't have much of a sector here which we don't right now anyway. It's really the quest for government money that is forcing innovation and that just isn't going to change in Canada. It's always about getting money from government".*

I-9, the Vice-President and Chief Scientific Officer of a natural health product company offered perhaps a more circumspect view on the issue of government funding. He observed that the policy framework currently in place in Canada forces certain actions in order to access program funding. *"The new government framework engulfs the Canadian functional food and natural health product sector so that if it wants to play – if it wants access to money – then it must work within the policy framework. For example, this includes the requirement of research and industry partnerships … unfortunately many of these partnerships are on paper in order for government and university researchers to get money with little benefit to industry".* The result is that government is attempting to force innovation *"but the reality is likely different".*

Crisis

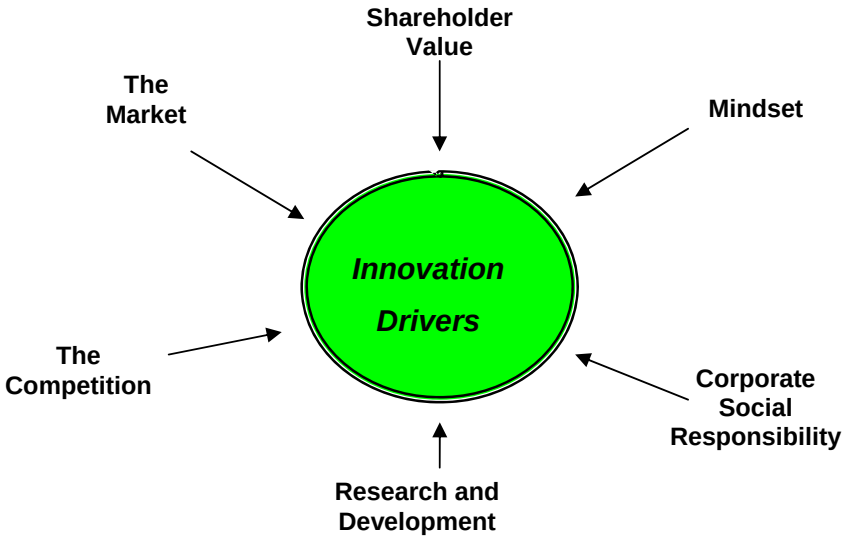
Finally, I-17 as well as I-7 argued that crisis in the form of the rising cost of food is forcing innovation in the functional food and food sectors. While new products and concepts were once the focus of innovation, 1-17, a president of a functional food company argues that the focus has forced innovation on the reduction of costs. He offered *"the high cost of food is forcing innovation to change and refocus direction to*

decreasing the cost of food. The food crisis … access to food and the high cost of food … is spurring innovation in a different direction".

5.1.2 Innovation drivers – actor group: food sector

Eight representatives of the food sector and one representative of the retail sector (I-2, I-10, I-21, I-11, I-13, I-22, I-24, I-25 and R-1) identified key drivers of innovation in their sector. In descending order of support, the drivers identified were in the following general areas: the market; shareholder value; mindset; corporate social responsibility; research and development; and the competition. They are depicted in Figure 29 below.

Figure 29: Key drivers of innovation - actor group food/retail



Each driver is explained below.

The market

Eight of the nine or almost ninety percent of the interviewees (I-2, I-10, I-11, I-13, I-21, I-22, I-25, R-1) identified the market as being the major driver of innovation. The market driver was put in the perspective of consumer demand but based on three demands: safe, quality products; healthy products; and new products.

I-13, I-21 and I-22 described the demand for safe, quality food products, regardless of whether they are deemed to be functional or traditional, as drivers of innovation.

[The definition of quality was not explored with the interviewee]. I-13 argued that his company's activities in innovation are driven by the *"demand for quality products that are safe. There is no place in the food industry and the market for products that are of poor quality and have questionable safety issues. You just won't last … The food industry is being forced to find solutions through innovative technologies that result in food that's safe. So traceability is going to be a huge factor in the future".* I-21, representing one of Canada's largest food companies and whose primary markets are Canada and the United States, concurred. As a result, he argued that the company is forced to innovate to compete with companies importing cheap food from overseas. He noted that *"we have found that people are comfortable with locally produced food … food produced in Canada and America. They equate it with food that is safe to eat. They like to know where it's from and that it's safe".*

Four interviewees, R-1, I-10, I-22 and I-25, described the market demand in terms of healthy products as being a driver of innovation throughout the nutrition sector. I-22 encapsulated the succinct points of the others by stating *"health has become a huge driver of innovation in the food sector".* And I-25 argued *"well, the food industry is being forced to innovate to make sure food is healthy. We don't have a choice. Consumers and the government are demanding it".*

Additionally, I-25 and R-1 identified the continual demand for new products in the market as a driver of innovation. I-25 argued that the market *"wants new things all the time".* He observed that this driver may actually be an impediment as consumers are often difficult to assess. He continued that *"new things … could be a detriment however because consumers may not recognize what is actually good for them".*

Similar to I-25's argument, R-1 noted the consumer factor as being both a driver and an issue in innovation. He argued that "*consumers are fickle. Why is it that consumers refuse to accept milk with additives but they love orange juice with calcium? That makes it so challenging … trying to figure out what consumers will accept and why. Consumers have gone from narrow confines – roast beef and potatoes – to new things. They want basmati rice, risotto, tabouli, rabbit, duck and the extreme of exotic foods that we wouldn't even feed our dogs … we're seeing that kind of spread in consumer behaviour and that's driving our innovation. It's really tough".*

Supplementing the market as the driver of innovation, interviewees I-2, I-11 and I-21 all described *"customers"* – buyers – as a key driver of innovation in the sector. All three interviewees represent major Canadian food companies. What is interesting was the different customer vantage point they took. I-2 and I-11 provided their observations of their own customers, but I-21 took the vantage point of his company as the customer.

I-2 and I-11 focused on access to shelf space at the retail level. I-2 explained *"the leading driver* [of innovation] *is customer expectation. Because we are one of the leaders in the Canadian food industry, customers expect us to be innovative … and while consumers are important, customer buy-in is more important … at the end of the day, our customer owns the shelf space and that's what it is all about".*

I-11 supported that argument but added that the retailer (in this case the customer) is driving the food industry towards incremental innovation and away from transformative innovation. He argued that *"the food industry is just so big now but controlled by so few retailers … and there is only so much shelf space. The rules of getting a spot on the shelf are so stringent now that true innovators, the ones with transformative innovations, have so much difficulty. There are a lot of great innovations but because the path is so cluttered with adaptations that the true innovations are just not getting through".*

While 1-21 recognizes his need to meet his customer demands, he looked at his company as the customer and being a driver of innovation. He argued that *"we're putting buyer pressure back up the supply chain … just as our own customers have put pressure on us. MNEs have done away with product development and pushed the technical innovation onto the supplier base".* He continued that one strategy his company follows to meet those expectations is to expect its selection of suppliers to do the same.

Shareholder value

Five food sector interviewees (I-11, I-13, I-21, I-22 and I-24) stated succinctly and factually that shareholder value is a key driver of innovation. And in all but one instance, I-24, was the first driver identified. I-22 summarized the point by observing *"making money is the number one driver* [of innovation] *… bringing value back to the investors … companies exist for the shareholders".* I-13 responded quickly to the question noting *"the need to provide shareholder value".*

I-11 added to the argument. He agrees with the rationale that shareholder or investor value must be realized. He added however that to do so, that value is accomplished through growth. *"Growth can happen many ways … through expanding into new markets … by penetrating current ones … or through new products. Sometimes innovation is the easiest path to growth and it also keeps the investors happy as long as you can show growth".*

Mindset

Two interviewees, I-25 and I-21, identified personal attributes of the innovator as driving innovation. I-25, the President of a Canadian technology based SME in the food sector discussed *"the endorphin release. Innovators like the highs and lows. The best way to spur innovation is to cut off the phones. Create a crisis".*

I-21 was less crisis driven but argued that *"the innovator's passion drives innovation … there is a human emotional attachment and attraction to innovation. It's high risk business. Sometimes the thrill of risk drives innovation".* He explained his experience in innovation during his career with his past and current employers. He stressed throughout the interview that *"fun must be part the innovation process. The thrill of risk and having fun drive innovators to do what they do … Many larger companies don't recognize those drivers. The companies that succeed in innovation don't dampen the entrepreneurial flair of its employees".*

Corporate social responsibility

I-10 and I-13 briefly identified corporate social responsibility (CSR) as a driver of innovation in the food and FFNHP sector. I-10, president of a Canadian food company with market leadership in North America, explained that CSR drives his company, *"if we want to leave the world a better place, then we must innovate – we must make improvements – we need to make this world a better place".* His emphasis on *"must"* implies that society is forced to innovate to meet the goals of social responsibility.

I-13 expressed the CSR innovation driver from a market-driven perspective. Clearly he argued that concern for the environment is a market opportunity and a driver of innovation. He concurred with I-10 however and added the twist of economic value for the company. He argued that this driver *"is a combination of the environmental impact of the food system plus societal concerns about the environment … in our*

case, the tipping point is the average citizen out there who sees food waste encroaching on their lives and is demanding that something be done about it". He explained that the amount of environmental food waste such as grape skins, carrot peelings and potato skins from food manufacturing has become such an issue that society is demanding that the food industry deal with this *"problem".* He explained that *"five years ago, society was not talking about the environment and the issue of food and other waste materials. Only environmentalists were … the problem is just so great that innovative solutions must be found. Society is demanding it".* He then added that the *"problem"* also represents a market opportunity such that companies developing the appropriate innovative technologies can gain "*economic returns for products made from the waste".* He gave the example of Vinifera For Life, an Ontario based start-up company that uses grape skins left from the making of wine, and transforms them into a flour to be used in the baking industry. The grape skins previously were ploughed into fields for fertilizer or transported to municipal waste sites.

Research and development

I-24 identified research and development (R&D) as a driver of innovation. Note that I-24's background is a recently retired Director of New Product Development of an MNE. He qualified his response by arguing that R&D in the food industry is different than in the information technology or pharmaceutical industries where innovation is driven by R&D. He explained: *"R&D usually drives innovation. Without R&D you wouldn't have innovation. But in the food industry, R&D is a liability. It's simply a service and is a necessary evil. It just isn't critical in the food industry. The returns just aren't there".*

The competition

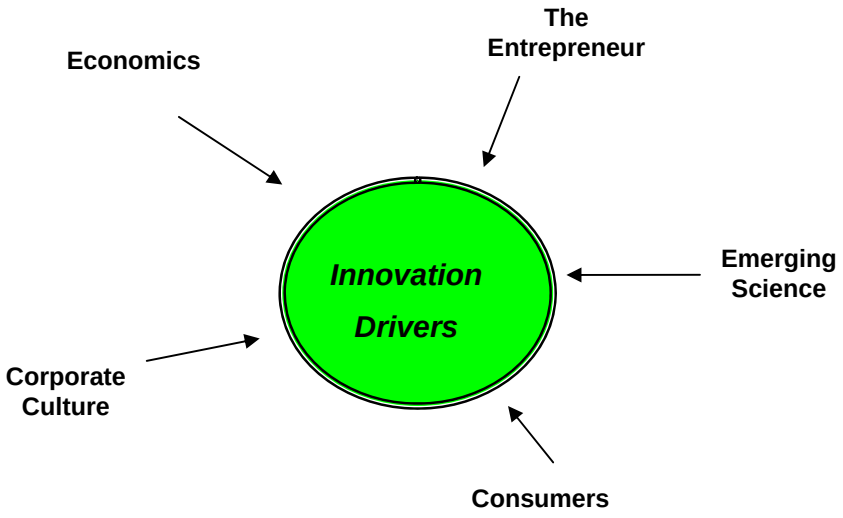
I-2, representing one of Canada's leading food manufacturers, stated the globally competitive environment is forcing companies to be innovative to remain competitive. He argued that *"there is so much global competition now that Canadian food companies must innovate in order to stay competitive and keep their products on the shelf".*

5.1.3 Innovation drivers – actor group: research/academia

The six research/academic interviewees (A-1, A-2, A-3, A-4, A-5, A-6) identified five drivers of innovation. In order of support, they are: economics; the entrepreneur;

emerging science; consumers; and corporate culture. They are depicted in Figure 30 below.

Figure 30: Key drivers of innovation - actor group research/academia



Each driver is explained below.

Economics

Three interviewees (A-2, A-3, A-5) identified economic factors as drivers of innovation. From the cost side, A-5 argued that companies in both the FFNHP and food industries are searching for methods to reduce costs. She noted that *"there is so much pressure on margins for all companies. Cost rules. The food sector is trying to incorporate health and wellness concepts but is very cost driven and in the NHP sector the competition is very heavy. It's all driven by costs".* Innovation therefore she argued is focused on production systems to reduce costs.

A-3 however approached the economic innovation driver from the revenue perspective. He spoke of innovation in general with no specific industry in mind. He argued that *"companies are looking for the next big thing. All things become obsolete so companies want to find the next big gold strike".*

The ability to secure funding for innovative activities is a key driver for innovation in A-2's viewpoint. Funding can be secured from government, industry or internal to an

organization. This argument complements the identified driver of corporate culture as outlined below.

The entrepreneur

A-2, A-4 and A-6 equate the concept of the entrepreneur with the innovator. A-2 suggested that *"entrepreneurs drive innovation but we have really driven that out of our educational system. We need to have entrepreneurship on the right scale if we are going to foster innovation in Canada … We don't pay enough attention to entrepreneurs in Canada. We train accountants".* A-4 supported that view and stated that Canada lacks a risk-taking culture required for innovation.

When posed the question regarding drivers, A-6 was hesitant. He stated that *"there are few, very few, entrepreneurial scientists in Canada".* He then identified Emerald Seeds Products as an innovative company founded by *"entrepreneurial farmers".*

The assumption therefore by these three interviewees is that innovation equates to entrepreneurism.

Emerging Science

A-1 and A-2 also identified the study of science and emerging science as an innovation driver.

Since consumers are demanding healthy food choices as identified previously, A-1 argues that *"innovation is being driven by the recognized need to understand the functionality of a nutrient – not just what the nutrient is. This is critical".* In other words, the scientific understanding of how a nutrient reacts in the body – the science behind the nutrient – is driving innovation.

A-2 provided another perspective. His observations were similar to those of G-4 who described the systems of innovation and the convergence of science creating new fields of study. A-2 argues that the understanding of science is evolving and leading to new fields which in turn are driving innovation. He explained: *"Science is emerging in fields we didn't even think of before – genomics, proteomics – understanding how plants and cells and systems work … emerging science will revolutionize this whole field and we aren't too far away from these changes … The explosion of science will push on one side and combined with the demographics and*

wealth of the older population will dramatically drive innovation in agriculture and health".

Consumers

Innovation is also being driven by consumers. A-1 and A-2 both cited consumers looking for good health as a driver. As a result, they are driving the food and FFNHP sectors to provide *"proven food guidance"* as described by A-1. Regardless of the demographic groupings, *"they each want healthy foods for various reasons. Older consumers wish nutritional choices that will keep them active and healthy. Generations X and Y wish to keep their families healthy".*

Corporate culture

A-3 argues that *"a specific corporate culture drives innovation … one that welcomes change and is not afraid of it".* Included in his remarks about corporate culture were the concepts of leadership and vision which engage the organization to *"buy into innovation".* He provided Google and YouTube as examples of leadership driving innovation: *"These are two good examples of crazy ideas that were applied and worked".* He added however the proviso, *"mind you the timing was right for them".*

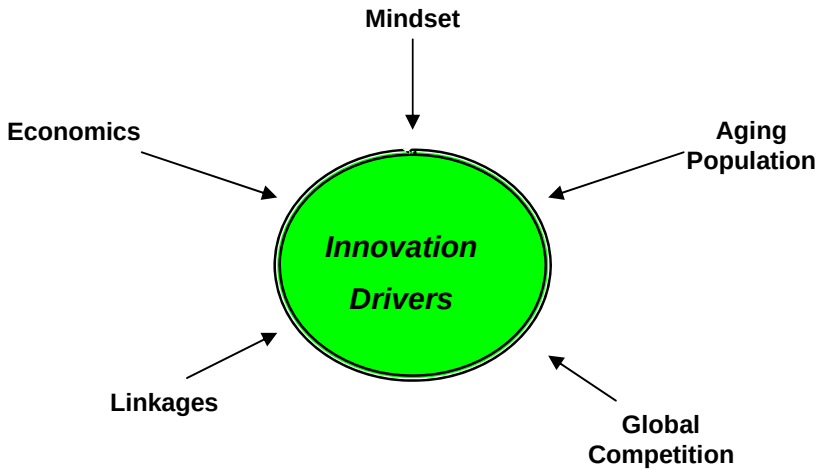
These views were supported by A-4 who also discussed a corporate culture that allows for *"big thinking and a champion".* During the interview it appeared that he equated *"big thinking"* with a *"champion".* He defined this concept as *"one that can 1) recognize innovation, 2) facilitate innovation, 3) create the conditions for innovation, and 4) inspire innovation".* In other words, he made a clear distinction between the innovator and a culture or person who facilitates it.

Unlike A-2 and A-6 who identified the innovator him/herself as being the driver, A-4 believes it is leadership and the corporate culture that drives it. He suggested that a leader or champion within an organization clears the pathway for the creative person – the innovator or entrepreneur – to innovate.

5.1.4 Innovation drivers – actor group: government

Five government interviewees (G-1, G-2, G-3, G-4 and G-6) identified the following five drivers of innovation. In order of support they were: economics; mindset; aging population; competition; and linkages. They are depicted in Figure 31 below.

Figure 31: Key drivers of innovation - actor group government



Economics

Four (G-2, G-3, G-4, G-6) of the five public servants identified economics as a key driver of innovation. G-3 focused on 'economics' from the expense side of the balance sheet. He argued that the rising costs of production are impacting Canadian manufacturers to such an extent that innovation is now focused at the reduction of those costs.

The other three interviewees however focused on the revenue side. It was the first driver each identified. G-4 offered the most introspective view. He argued: *"I'm a big believer that innovation should be socially or environmentally driven. But the reality is that it still comes down to the economics … and particularly with this government".*

Mindset

G-4 and G-6 spoke of the internal drive and mindset of the innovator. They argued that regardless of other factors, there is an internal component to the innovator that drives them. It can be the *"quest and thrill of looking for something new"* (G-6) or the *"love of research and curiosity of the science and technology people who just love their topic and are passionate about new ideas … they just don't let go".*

The mindset of the innovator was also described as *"an innate drive".* G-6 at first struggled to describe what she meant but then offered the following example: *"I took*

violin lessons for fourteen years. I passed all the grades. My parents spent thousands of dollars on my lessons. I play at weddings and other occasions. I can play the violin but that doesn't make me a violinist. I don't have that wiring. I don't have that innate drive. It's the same thing with an innovator. They have that innate drive, that mindset that's missing in other people".

Aging population

Two government interviewees identified the aging population as drivers of innovation. G-1 and G-2 both spoke of the implication of an aging population with respect to rising healthcare costs and the need to keep this demographic segment healthy. G-1 argued that *"before, we retired at sixty-five and died at sixty-six. Now people are living thirty years beyond retirement and we need to keep them well, not only because it's the right thing to do but because our healthcare system won't be able to handle the heavy cost burden".*

This driver is linked with the previous one of economics.

Global competition

Global competition is also a driver of innovation. G-3 and G-4 both referred to the increased pressure from outside Canada but from different perspectives. G-3 discussed it with respect to business interests while G-4 referred to research and development activity.

G-3 argued that innovation does not occur in a non-competitive environment. International competitive intensity however has increased putting increased pressure on Canadian businesses *"to innovate or perish"*.

G-4 identified the *"global research and development supply chains becoming very competitive. But where do we* [Canada] *fit in all of that and how can we be part of those supply chains so that we can extract value from the chains to be competitive?"* Note that during the discussion, he interchanged the verbiage *"global research and development supply chains"* with *"science and technology supply chains".* G-4 argued that the global research and development chains have become very competitive. His point is linked closely with his identification of linkages as a driver of innovation as outlined below.

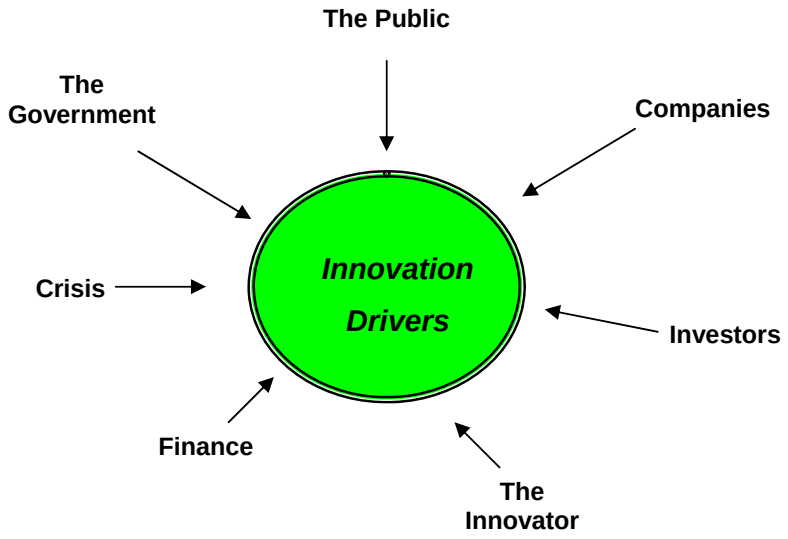
Linkages

G-4 followed his comments regarding the competitive nature of global research and development supply chains with the growing importance of international linkages among scientists. He argued that these linkages are not only driving innovation, but accelerating the rate of innovation. Science has become so specialized that any one country *"cannot possibly have all the expertise required to understand these new domains".* He reiterated the challenge of these international linkages in extracting value back to the country.

5.1.5 Innovation drivers – actor group: non government organization

The two representatives of non government organizations, NGO-1 and NGO-2 identified six drivers of innovation: government; the public; companies; investors; the innovator; finance; and crisis. They are depicted in Figure 32 below.

Figure 32: Key drivers of innovation - actor group nongovernment organization



Each driver is explained below.

Government

NGO-1 stated that to *"understand the drivers, it's important to understand the motivation of the players".* In the end, he argued that it was *"the players"* themselves who drive innovation. He identified the government as the first driver/player. He suggested that countries are *"desperately seeking a global competitive lead"* in the

market. As a result, governments entice companies to innovate through policy initiatives. He specifically identified the *"R&D tax incentives"* offered by the government. These incentives ease cash flow issues of companies and allow them to invest in research and development which leads to the commercialization of new products. The intended impact is a boost in the economy.

NGO-2 offered that government *"can overtly force innovation or at the very least strongly encourage it. It can do it by using certain wording".* He discussed the very nature of the wording used by the American Food and Drug Administration and that of Health Canada. He observed that *"the FDA for example when they approved DHA used language that said 'we encourage American citizens to consume this at this level' which is a much different statement than we have which is 'we have no objections to its use'. That very statement by the FDA has spawned innovation in the U.S. But Health Canada's statement is much less encouraging and does not send the right message".*

The public

Within the realm of government, NGO-1 also identified the public good as a driver *"by being the right thing to do".* When queried regarding who judges or suggests "*what is right*", he argued that *"it's the electorate who determines what is in their interest and directs the politicians through the electoral process".* He continued that academia can determine *"what is right based on their research and then they press their case to the public who then pressures the politicians".*

Crisis

Following on the pathway of the drivers of NGO-1, NGO-2 argues that *"the major driver of innovation is crisis including political discontent".* He gave the example of the difficulties faced by producers on small family farms in Canada. He noted that producers require off-farm income to be able to stay on the land. The discontent of this group which NGO-2 sees as being in a crisis situation, *"has put pressure on the government to do something … That's why there are programs now supporting innovation in agriculture".*

Companies

NGO-1 also identified companies as being drivers of innovation. While interviewees in the other actor groups expressed this driver in terms of the competition or the competitive environment driving innovation so that companies can gain a competitive

advantage, NGO-1 argued that *"it's the businesses – the companies – that are driving innovation as they see innovation providing a competitive advantage … it's just so competitive out there".*

NGO-2 agreed and argued that *"this sector is comprised of so many cottage industry folks like the cranberry growers, the soyabean growers and the grape growers. They are looking for ways to be competitive in the marketplace and use all of their bio materials for food and non-food uses. Vinifera For Life is a good example of an innovative company* [also referenced by I-13 above]. *It took all of the grape skins and made a flour used in … bread, high in antioxidants. By looking at new uses of previously considered waste materials, less bio materials are going into landfills".* He continued that the *"stakeholders along the entire supply chain are forced to innovative to be competitive".*

Investors

In a similar vein, NGO-1 argued that investors are driving innovation *"as a means to increase the return on investment".* While other interviewees have focused on the demand for the return on investment, NGO-1 personalized the demand by identifying the investor specifically.

The innovator

NGO-1 and NGO-2 also identified the innovator or aspects of the innovator as a driver of innovation. NGO-2 explained: *"Innovation is very entrepreneurial, so we must focus on the people and not on the products. The products will come".*

NGO-1 changed his focus of the drivers. He turned to attributes of a person rather than the stakeholder him or herself. He argued that *"it's the ego of the entrepreneur that drives innovation … And once that entrepreneur has succeeded once, success drives it as well. He* [sic] *says 'I've done it once and I can do it again'".* That last statement also refers to the ego of the innovator. NGO-1 links the term entrepreneur with that of the innovator. He continued, *"it takes the gumption of an entrepreneur to apply R&D. In Canada, we have a lot of small business people, but we have a shortage of entrepreneurs and risk takers".*

Finance

Finally, NGO-2 described availability of funding or finance as a driver of innovation. He argued that investors have numerous opportunities to invest their money with

respect to industries and companies. It is therefore difficult for the agriculture and food sector to attract that investment since return on investment is usually lower than in other industries. He observed that *"currently there is an investment gap in the agriculture and food sector. There are too many other options for investors that the food system just doesn't attract the big investor".*

5.2 Measuring innovation

> *"Measuring innovation? Nobody does it well because it's that hard and that complex". A-2*

Once the interviewees had discussed the drivers of innovation, the focus then turned to third research question: How is innovation measured? To begin the investigation into this question, the interviewees were each asked if their organization has specific objectives regarding innovation. They were then asked how innovation is measured in their organization and finally if they expect innovation measures to change in the future.

Table 14 below provides an overview of innovation objectives in organizations for all actor groups.

Table 14: Does your organization have specific objectives regarding innovation?

Respondent Category	Yes	Yes-Qualified	No	No response
FFNHP	4 (1-7,I-23,I-12, I-19)	4 (1-8,I-15,I-17,I-20)	9 (I-1,I-3,I-4,I-5,I-6,I-9, I-14,I-16,I-18)	0
Food / Retail	3 (1-2,I-10,I-13)	1 (I-21)	2 (I-24,I-25)	3 (I-11,1-22,R-1)
Research / Academia	1 (A-1)	0	5 (A-2,A-3,A-4,A-5,A-6)	0
Government	1 (G-4)	1 (G-2)	3 (G-1,G-3,G-6)	0
NGO	1 (NGO-1)		1 (NGO-2)	
Total	10	6	20	3

The table indicates that only forty-one percent of the organizations have innovation goals or objectives and that industry is more likely than other actor groups to have them.

Table 15 below provides an overview of the key measures of innovation as described by the various actor groups.

Table 15: Measure of innovation by actor group

FFNHP	Food / Retail	Academic / Research	Government	NGO
Contribution to profit	Economics	Number of publications	Inputs • Capacity and capability of research • Technology parks • Government procurement	Economics
Number of new ideas	Corporate social responsibility	Corporate culture • Risk tolerance	Outcomes	Social
Number of new products	Intellectual property rights	Economics	Tolerance for risk	Assistance to innovative companies
Benefit of the product	Control of company	Number of knowledge workers		
Intellectual property rights	Government support	Access to grants		
	Safety	Intellectual property rights		
	Consumer reaction			

The following section provides a more in-depth description regarding measuring innovation within organizations by actor groups.

5.2.1 Innovation measures – actor group: FFNHP sector

> *"Understanding the measures for innovation in the FFNHP sector? We're pretty early on in this. The sector is pretty new. We're just starting to grapple with this now?" Vice-President, NHP company*

Interviewees representing the FFNHP sector were somewhat balanced in their responses regarding specific innovation objectives in their companies. While nine interviewees stated that they did not have specific innovation objectives, four provided affirmative responses with an additional four providing a qualified positive response.

Four of the FFNHP interviewees (1-7, I-23, I-12, I-19) stated that their companies have specific innovation objectives. I-7 who represents an organization focused on *"human health"* stated that almost all revenue currently received focuses on innovation. She explained that *"the goal is to commercialize the research using industrial partnerships … companies that have the market access and capabilities to ensure that the research is commercialized appropriately and with the best chance of*

success in the market … but it's hard". She argued that *"it is increasingly difficult to implement the strategy because some of the partnerships are outside of Canada. Government funding often does not support research being conducted elsewhere and since much of our revenue at the present time is sourced from the government, we're facing huge challenges to meet our innovation objectives … and this will be an increasing battle in the future for everyone due to the growing complexities of innovation and emerging science".*

I-7's point is particularly interestingly given G-4's observations regarding global research and developing supply chains and international linkages (see previous section). G-4 is a senior policy advisor in science and technology, and innovation with the federal government. While he recognizes the reality of the shift from domestic linkages in research and development to international linkages, it is clear that the federal government has not found the solution through policy or programs to facilitate participation in these chains on the part of private industry. The impact of the inaction to date has led to I-7's response indicating that government policy limits her company's ability to meet its innovation objectives.

Innovation goals have also been set by I-12's company. Similar to 1-7, she focused on the issue of research which was consistent with her view of innovation linking the concept to discovery. She offered however *"that every department in the company sees it differently. I am lucky because the scientific goals meet the goals of the business development department … we are committed to bringing the right product to the market that stands up to government scrutiny, here and in other countries".*

I-19 stated that her company has innovation objectives but would not discuss this question further as she viewed it as confidential information.

I-23 also noted that her company has innovation objectives. She commented that while the company has been in business for ten years, it only recently set formalized innovation goals. She stated that the innovation goals are expressed in terms of financial and new product development objectives.

I-20 also discussed her company's approach to innovation. When asked whether they had specific innovation goals, she stated: *"sort of. It's more along the lines of product development objectives. We have rules for product development: it must be*

a product derived from traditional use; it must be patentable; and it must be evidence based".

In line with I-20's company's *"sort of"* innovation objectives, I-8, I-15, I-17 and I-19 offered that their companies do have them but either could not specifically recall them, linked them directly to research and development goals (I-15 and I-17) or considered them to be confidential (I-19). I-17 noted that *"research and development is the heart of a company or it should be if you are innovative".*

It is interesting to note that while some interviewees see their research and development (R&D) goals or objectives as just different terminology for innovation goals or objectives, others do not. For example, I-16 stated that his company has no specific objectives in this area *"but the company does have R&D goals and tries to harness the creativity of the scientific team. We allow the scientists to explore various interests but have processes in place to guide the discoveries to the marketplace … The real problem we have is identifying which of the ideas is really the best one we should chase and develop"*

Likewise, I-18 argues that his company has no innovation goals but its *"approach is to develop transformative innovation through partnerships at universities and then apply the incremental value at the company level".* I-4 explained the same approach taken by his company. It has linked with many universities in the United States and Canada to develop their products.

None of the companies affiliated with I-1, I-3, I-6 and I-9 have specific goals or objectives with respect to innovation. Interestingly, it is a conscious decision not to do so. Each interviewee stated their view of innovation as serendipitous or requiring freedom to explore. The consequence is that they argue it would be inappropriate to set goals or objectives in this area. I-14 provided his company's rationale. *"You can't dictate innovation. We need the freedom to explore"*. He noted that as a company grows it is difficult to continue the freedom. He continued, *"when we were smaller … we were entrepreneurs – we were mavericks – we were left alone and given the freedom to come up with new things. But now that we are a large company, we have had to put in place certain structures and processes. Our core research interest remains and we are fortunate that we are still free to explore any interest we have".* Even though he stated that the company has no innovation goals, he continued that the *"higher priority is to develop adaptive or incremental solutions*

for buyers in the area of existing products for existing markets. The lowest priority is new technology for new markets".

I-9 also spoke about freedom to operate. He argued that while his company has set specific *"outcomes … innovation is used as one tool to achieving those outcomes … You must allow for flexibility".* He questioned that if a company sets innovation goals, *"then how do you plan for things that are unexpected?"* He gave the example of the discovery of penicillin which *"should have been thrown away".* He continued that it was the freedom to explore that resulted in penicillin.

I-1 concurred with the previous need to allow for freedom and flexibility. He has specifically not set innovation goals for the company so that the company is *"able to pursue emergent opportunities – so we need to be flexible in order to react … These emergent opportunities are more powerful for a small company than having a set plan".*

While I-3 supported those views as well arguing that "*innovation just happens and it requires an entrepreneurial attitude … and therefore somewhat serendipitous".* His other point may have been more revealing however when he stated that his company has no specific innovation objectives *"because of the money. The focus is on keeping the doors open".*

Two additional points of interest arose during the interviewee responses in the area of innovation goals or objectives: investment in research and development and *"sweat equity".*

Ten of the seventeen FFNHP interviewees identified their company's investment targets in research and development. This is important since this industry claims to be science based as well as being a metric of innovation by the World Economic Forum. One interviewee, I-7 stated that her organization devotes one hundred percent of its revenues currently to innovation. The other nine focused on the terminology 'research and development'. Interviewees stating that their companies have innovation goals or provided a qualified affirmative response identified the following percentage of sales targeted at research and development in their company: I-17 targets fifty percent; I-12 targets thirty to forty percent; I-15 and I-23 each target one percent; and I-19 targets half a percentage of sales. Four of the nine interviewees stating that their companies do not have innovation goals identified the

following percentage of sales targeted towards research and development of their company: I-9 *"is striving for four to five percent"*; I-6 targets three to four percent; I-1 targets three percent; and I-18 targets one to three percent.

The contribution of *"sweat equity"* (i.e. time investment or individual effort) was also identified by seven interviewees (I-1, I-3, I-4, I-6, I-15, I-17 and I-19). Each of these interviewees highlighted the importance of individual contribution to innovation which they deem to be an invaluable component or a *"critical component"* (I-6) of the concept. I-1 noted that while his company invests approximately three percent of sales on research and development, *"sweat equity is almost incalculable".* I-3 expressed his interpretation as *"it's sweat equity of the entrepreneur that turns into innovation. It takes a personal effort to jump into innovation. The MNEs have the money for it while the SMEs have the sweat equity".* I-4 concurs with that view arguing *"SMEs put far more sweat equity into innovation than large companies".*

I-3 goes one step further however placing a great deal of importance on the contribution of sweat equity to innovation. He questions whether large companies can be innovative. He argued that *"as small companies move into being large companies, they lose their ability to innovate because they lose the sweat equity … As they get into the maturity curve they lose their ability to innovate".* Note that I-3's concept of innovation entails transformative products.

Measures of innovation

The FFNHP interviewees were asked to provide their view on measuring innovation.

Three interviewees (I-12, I-14 and I-17) questioned whether innovation can be measured due to their views of the personal nature of innovation. I-17 cautioned that *"measurement could be very subjective"*. He questioned whether measurements have any validity.

I-12 refers to innovation as *"an addiction for the innovator … For a true innovator, the quest for innovation never stops. You can't measure it because you never achieve it. There are too many questions to answer … it becomes an addiction".* She argues therefore that innovation is impossible to measure. And yet, she identified that her company has innovation goals.

I-17 acknowledged the personal nature of innovation but noted that the personal nature is in itself a measure. He argued *"the measure is if it* [innovation] *meets my*

own need … innovation is very personal and therefore, the measure is whether the innovation meets a need in MY [emphasis his] *life".*

Additional measurement factors add to the difficulty in measuring innovation. I-15 argues that *"measuring innovation is a big sticking point because we do so much that just can't be valued".* She continued that two measures of innovation are company or staff "*reputation and global recognition as leaders by competitors and academic researchers. But that's pretty difficult to measure".*

Other measures of innovation were identified however, some more quantifiable than others. The measures identified were in order of support from the interviewees: contribution to profit either through sales or new users; the number of new ideas and products; benefit; and intellectual property rights.

Contribution to profit

All (I-1, I-3, I-4, I-6, I-7, I-8, I-9, I-12, I-14, I-16, I-17, I-18, I-20 and I-23) but three or eighty-two percent of the FFNHP interviewees identified contribution to company profit as the primary measure of innovation. The contribution was mainly defined through sales' revenues while I-20 defined the contribution through new users or new markets *"contributing to the financial health of the company".*

While most respondents stated the measure concisely, I-4 added *"consumers are so sceptical these days, sales tell us the confidence level of the consumers … Measuring innovation is all through sales".*

I-23, I-8 and I-3 focused their measurement not just on contribution to company profit but sustained contribution. I-23 expressed the sustainability through *"an extended life cycle for the innovative products"* that contributes over an extended period of time. I-3 used the term *"longevity".*

I-8 also supported this view arguing that *"the true measure is about whether the innovation has holding power in the market. The challenge is that functional foods must be on the shelf for eight to ten years before you can say that it has staying power – before you can consider it successful – not the two years that is the norm with the food industry".* This statement was inconsistent with his premise that innovation is discovery and does not require commercialization to be considered innovation. This is an example of the struggle many interviewees faced during the

interview and demonstrates how their own concept of innovation evolved throughout the interview.

Number of new ideas and products

The next most cited measure of innovation by the FFNHP interviewees was the number of ideas generated and new products generated. Seven interviewees (I-1, I-3, I-6, I-16, I-19, I-20 and I-23) concurred. Most were concise in their responses.

The question becomes whether the products brought to the market are truly innovative. While measuring the contribution of innovation to the product line is difficult, I-6 argued that if a company depends on innovation to produce a product *"you need to ask if you took innovation out of the mix, what would it do to your production and product line"?*

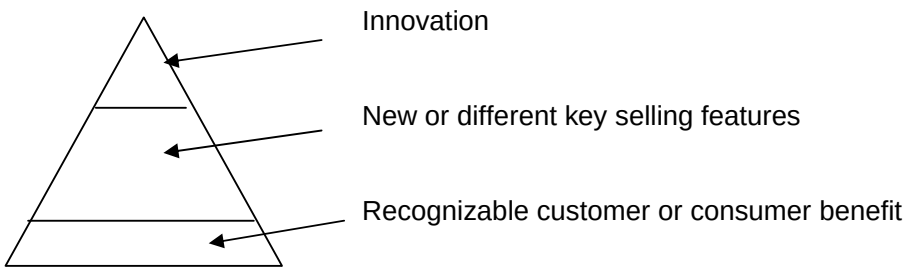
I-20 and I-23 expanded their responses to include upstream product development through the generation of ideas that result in new products. I-23 stated that her company *"measures the number of new ideas coming down the pipeline … and then how many result in new products".*

Benefit

Benefit as a measure of innovation was identified by six interviewees (I-1, I-3, I-5, I-15, I-16 and I-17) from the perspective of consumers, the national economy and society.

The following diagram was described on page 165 to demonstrate I-1's concept of innovation. It is reproduced below to explain his description of the consumer benefit.

Figure 33: Product development pyramid



I-1 argues that the measure of innovation is whether it offers new or different key selling features. He provided the example of granola that contains no flax. Once flax is added, then he argues, it should be considered innovative since the key measure is the added omega-3 content that it did not contain before but is now a key selling feature. He used this example to demonstrate why innovation in the FFNHP is difficult. While the innovation resulted in a new selling feature, *"there is no recognizable consumer benefit … consumers don't immediately feel a benefit, like they would if they took a medicine to treat something. Innovation is really tough in this sector".*

I-15 also cited consumer benefit as a measure. She argues that the benefit is compared to products currently offered in the marketplace. She observed that innovation is measured by *"the degree of benefit the product offers in relation to competitive products".*

Societal benefits were also identified. I-15 offered some insight into this concept. She actually put it in terms of *"making a difference in people's lives".* She argues that her company has *"received numerous testimonials concerning the health benefits received from their products and the difference they have made in their lives".* While she acknowledged that in many cases, the contribution to health is difficult to measure, she argues that *"it's the most important measure".*

I-3 supported the concept of measuring human health but questioned the validity of doing so at this time. While he believes that in the future it is likely that a measure of innovation in this sector could be *"the rate of human health"* he questioned whether it is possible in the foreseeable future. *"How do you really attribute someone's health to specific product? It will be a real challenge because there are so many factors at play in a person's health".*

I-4 however took on that challenge. He discussed *"the societal measure"* within the *"concept of 'presenteeism' and the effects of being at work sick … a person who comes to work sick infects seven people".* He argued therefore that a measure could be the reduction in lost work days if a chosen population used certain natural health products.

Finally within this component of benefit, is the benefit to the national economy. I-1 argued that innovation, regardless of whether it occurs in this sector or other sectors,

should be measured by its *"contribution to the country's GDP"* (gross domestic product). He then linked the social measures to the GDP. He argued that if functional foods and natural health care products reduced health care costs and increased productivity, the innovation through those measures is a clear contribution to GDP. His rationale is consistent with the argument of 'presenteeism' put forward by I-4.

Intellectual property rights

I-9 and I-19 identified intellectual property rights as a measure of innovation. I-9 simply stated it in *"the amount of IPR – patents or trademarks – that can be linked to discoveries … and the novelty of the product".* I-19 also presented this view and stated that *"there needs to be some intellectual property attached to innovation".* She continued that her company has *"over forty-five patents pending and many people forget about trademarks when it comes to IP. If you can trade mark the innovation, then that's another measure".*

Future measures

The FFNHP interviewees were asked if the measures of innovation they identified were expected to change in the future. Only two interviewees (I-17 and I-20) provided an affirmative response.

I-17 believes that the measure of innovation will focus on cost cutting measures across all forms of manufacturing.

I-20 argued that corporate social responsibility will be the most important measure of innovation in the future because *"consumers will demand it".* She described a consumer survey her company recently conducted. The company was surprised at the number of consumers *"who are now taking social responsibility into their purchasing decisions. This is only going to be more important in the future".*

Only one interviewee, I-7, said that she did not know how innovation will be measured in the future. She wondered aloud that *"innovation is only going to get more complex in the future due to global collaborations across the value chain, so I don't know how it will be measured".* Her observation may be more of a question where it will be measured. If collaborations include different actor groups across multiple countries, where and to whom innovation will be attributed may be an issue for governments that set innovation as a national goal.

5.2.2 Innovation measures – actor group: food sector

The food and retail sector interviewees were asked if their companies have specific innovation goals or objectives. Three interviewees (I-2, I-10 and I-13) responded that they do. One interviewee (I-21) provided a qualified yes response. I-24 and I-25 both stated that their companies do not. And three interviewees (I-11, I-22 and R-1) refused to answer the question.

I-2 described his company's approach to innovation. This company is one of the largest food companies in Canada. Its innovation objective is to *"introduce one or two innovative platforms every two years".* He also emphasized that *"the platforms must NOT* [his emphasis] *be one-offs and must have multiple product applications".*

I-10, company president of a large Canadian food company that leads in several market segments in Canada and the United States, rephrased the researcher's question by asking *"are you asking if my company's approach to innovation is deliberate? The answer is yes and no".* His company's approach to innovation is to remove any barriers to continual improvement. To identify those barriers and seek solutions for their removal, *"the company has town hall meetings every three months for all employees. The meetings are led by me. We explore every way in which the company can improve and sustain its social responsibility … the culture of transparency is critical to continual improvement. The approach must be never to let management ego get in the way of improvement".* This approach to innovation is consistent with his concept of innovation that focuses on process improvement to return value to the company and society. He added however a more specific objective, in that he *"expects and aims for fifteen percent of growth to be a result of innovation".* To put this in perspective, he noted that his company is growing at an annual rate of thirty percent.

I-13 represents a much smaller company in the Canadian food sector. While innovation is a critical component of the company currently, he admitted that *"we didn't set out to look at innovation but rather a business opportunity that involved new technology … but we now see innovation as giving us the leading edge".* While the company has incorporated *"innovation into the budget, the reality is that we can't afford to hire the right people … so our innovation approach is to access the right people using external agencies and government programs".* The company however is now questioning partnerships with government because *"it is becoming costly and*

very time consuming to deal with government programs … we are now questioning the value of partnering with government anymore".

I-21 is the Vice President of Innovation for a major Canadian food company with international markets. He provided a qualified yes in response to the question whether his company has innovation objectives. He offered that his company is just forming the objectives and that he has been given a team to devote to innovation activities which he maintains are "*all about traceability and regulatory compliance".* He also offered that it is difficult to have very specific innovation objectives *"because we can't chase too many at a time. We need to identify which ones will take priority".*

This interviewee also cautioned about focusing on innovation that is a result of set objectives. Consistent with his concept of innovation, he argued that *"there is also serendipity attached to innovation where innovation occurs that is not a result of set objectives".* He provided an example of serendipity that occurred at a previous place of employment several years ago. The scientific team had developed fibres that would better hold a food product together so that it did not easily fall apart when eaten. *"Nothing was done with the innovation until the president of the company came walking in the door with ice cream all over his shirt. The ice cream cone that he had during lunch broke and spilled all over his shirt. We* [the company scientists] *realized that the fibre could be used to make a more durable cone. Today, they all use that invention".*

I-24 who is a recent retiree of an MNE stated that the company had no innovation objectives or goals. He stated *"not really. It's mostly focused on new product development which I don't consider to be innovation".* He explained that *"smarter people than me have been trying to figure that one out. We dabbled in it before I retired but we never came to a conclusion … Actually, I have no idea how to measure it. We spent a huge amount of energy trying to figure this one out but never came to a conclusion".*

Measures of innovation

The remaining interviewees identified seven overall measures with the primary measure under the umbrella of economics. Other measures were: corporate social responsibility (I-10, I-22); intellectual property rights (I-10); maintaining company control (I-10); level of government support (I-13); safety (I-22); and consumer reaction (I-11).

Economics

Economic measurement was the predominant measure identified by seven interviewees (I-2, I-10, I-11, I-13, I-21, I-22, R-1). I-22, a representative of an MNE, was the bluntest and responded with "nothing says thanks better than I can take it to the bank. We're in the business of making money. If there's no profit, the best ideas won't get off the ground". He provided an example of the necessity of economic measurement. He explained that "MREs [meals ready to eat] have been around since the mid 70s. But it is only recently that they have hit mainstream. The quality is now good. The innovation is that they have done a good job at marrying quality, taste and convenience. That innovation allows them to make money and why we are involved".

R-1, I-13 and I-2 supported the financial measures' component of innovation as well. R-1 argued that "*the cost of innovation is high and you have to be able to realize a return on innovation".* His concern is that it often takes time to build a brand that incorporates innovation. He argued that investors now demand short term paybacks which he considers to be a "*huge detriment to publicly owned companies"*. In his view, privately held companies have better *"staying power because investors are generally more patient"*. He provided the example of two products: *"I always say that if Dove or VIM were launched today, they would never survive. It really took them ten years to show any results from either product. That wouldn't happen now. The stock market investors are demanding performance. There is little incentive in a public company to undertake innovation because innovation is so long term. Investors* [in publicly traded companies] *demand immediate return or they will take their money out and invest in another company".* He continued however that the measure needs to be long-term or sustainable sales. This point is consistent with that expressed by I-3, I-8 and I-23 as noted above.

I-2 offered further insight. He is responsible for innovation at one of Canada's largest food companies. He agreed that economic measures are the primary consideration and discussed why the food sector focuses on incremental innovation. He gave the example of the launch in the 1980s of the fully cooked roast of beef. *"It was originally launched in 1987 but pulled from the market quickly as consumers were not ready for it. The company re-launched it in 2003 with some variation and has done well with it. Innovation takes commitment and this example demonstrates that you don't throw the baby out with the bathwater".* He argued that the timing was wrong for introduction in 1987. Consumers at that time were not demanding convenience

products. While the company was successful the second time, he argued that *"companies have too much difficulty in revamping a product and re-entering the market. The cost is far too high. We likely wouldn't do that again".* When asked for further clarification, he observed that if the company had the proper consumer insight at the time, the original product would not have been introduced in 1987. The investment and risk were too high. In his opinion, the company *"should have kept the innovative technology until the innovation was consistent with market trends and demand. The cost to the company was just too high".*

I-11 also noted financial measurement. He argued that the *"key measure in the food industry is the percentage of sales in the current year from innovative products that have been introduced over the previous three years".* I-10 also made this point. I-11's concern however is the confusion over the interpretation of the word 'innovative'. *"The question however is the distinction between new and innovative products. Many companies lump them together when really there is no innovation. Food companies are fearful of NOT* [his emphasis] *being viewed as innovative and so overuse that term"*. His concern is consistent with that of many interviewees in the FFNHP sector who believe that the sector is rife with 'me-too' products that claim to be innovative.

Consistent with economic measures, I-11 identified another economic measure of innovation – *"growth of a company that results from innovation".* He explained that *"companies need to grow and growth comes from strength and endurance not expansion. Companies that grow need fifteen to twenty percent growth as a result of innovation. The innovation could come from an innovative design, packaging, creation of a new category, or application of new technology to an old category that transforms the category"*. He provided an example in reference to the last point. He described how *"three scientific innovations were adapted resulting in a commercial innovation in Canada".* McCain's Pizza Premier, introduced in the mid 1990s, *"transformed the frozen pizza category in Canada. The results were pizzas that tasted like pizza, not cardboard, when cooked"*. His line of thought is consistent with his observations of different categories of innovation (i.e. scientific innovation and commercial innovation).

I-21 added the final economic measure by arguing that an innovation measure *"is how much you reduce costs".* He provided an example of the high cost in the food sector of water and effluent *"and the need for attention to waste management. In this*

instance, if the rinse water towards the end of the process could be converted for use as starting water, the pay-off could be huge for the company".

Consumer reaction

Consumer reaction was noted as a measure of innovation by I-11. He argued that since *"innovation is in the eye of the beholder, it must be astounding and delightful to the user".* When asked how a company measures 'astounding and delightful', he observed that it is through sales. He argued that while his measure supplements the economic measure, he believes that 'astounding and delightful' should stand on its own as an innovation measure.

Corporate social responsibility

Two interviewees, I-10 and I-22, identified factors relating to corporate social responsibility as key measures of innovation. I-10 expressed his commitment to the supply chain by stating measures include *"reducing the footprint left by my company"*. The second CSR measure he noted was *"assisting farmers to stay on the land - the unsung heroes of the food chain".*

I-22 stated that his company is beginning to formulate innovation measures around *"sustainability, like innovations in energy, water and air efficiencies"*. When questioned regarding the intent of sustainability, whether it was economic or CSR driver, he stated it was the latter.

Intellectual property rights

I-2 stated briefly as his final measure of innovation that some form of intellectual property must be attached. He then expanded on this point. He is unsure as to how this will unfold in the future. *"There will be increased emphasis and confusion in IP as an increasing number of technologies are being developed through collaborations and using different models. The questions will be: who owns the resulting IPR and what efforts will be required in the future to protect it?"*

Maintaining company control

For I-10, a primary measure of innovation is his ability to *"keep the company as a family business"*. He then identified four MNEs who have attempted to purchase his company. He argues that innovation will keep his company *"continually outselling the competition … and ensuring a family legacy"*.

Level of government support

Representing a Canadian SME, I-13 believes that support from government is a measure of innovation. He argues that if the federal and provincial governments provide an *"appropriate regulatory environment and support for infrastructure through access to various funding programs"*, then those actions are an indication of innovation. His rationale is that the various levels of governments *"all talk about innovation, so if they support it, then that is a measure".*

Safety

I-22, representing an MNE, identified safety as a measurement of innovation. *"Safety has now become a mantra in the food sector … Safety is at the forefront of innovation"*.

5.2.3 Measuring innovation – actor group: research/academia

Only one of six representatives of the research and academia actor group stated that his organization has innovation objectives. A-1, a researcher in one of Canada's leading universities and consultant to MNEs and SMEs in the global food and FFNHP sector, stated that his university has specific innovation objectives. The approach taken by that university is to identify innovation priorities. Once identified, *"private companies are approached to provide funding for research in the specific departments. Those companies then are given the right of first refusal for patentable innovations".*

A-2, representing another university, noted *"no and we should with relation to entrepreneurship and education".* He continued however that the administration of his university likely views research goals as innovation goals. A-4, President of a research and development organization serving the food and FFNHP sector globally, also noted that his organization has no specific innovation goals because *"the organization responds to the needs of the clients, so it's tough to have objectives around innovation".*

A-6 represents a scientific research institute receiving most of its funding from the government. It serves the entire food system. He stated that his organization does not have specific innovation objectives and that in fact, there *"has been a steady erosion for federally funded science in this country that has been going on since the Mulroney years* [Prime Minister Brain Mulroney from September 1984 to June 1993] *… The kicker will come when the government has to deal with the growing deficit*

from this recession. They will start by savaging funding of all non essential research". In other words, he expects research to suffer in Canada over the next few years which in his view is the foundation of innovation.

Measures of innovation

All six research/academic interviewees addressed the issue of measuring innovation. A-2 however questioned the ability to measure innovation. When he was asked how innovation is measured, he responded *"very carefully. Innovation is such that you can't use a cookie cutter measure. Any cookie cutter measure will change with the next innovation. Discrete changes cause different measures … nobody does it* [measuring innovation] *well … it's that hard and that complex. You need a very intelligent understanding of the gains of innovation and the benefits of innovation to measure it".* He continued about measurements in the FFNHP sector. He argued, *"at the sector level, we could look at whether any money is being made, but then you also need to look at what health gains can be attributed to the use of nutraceuticals. I'm not sure of anyone who does it well. It's that hard … we don't quantify it and if we did, it could lead to real investment in innovation in this area".*

A-6 was also troubled by the question of measuring innovation. He argued that "*measuring innovation is about measuring something that is not measurable because we can't really agree on what innovation is and what it is not".* He concurred with I-7 who noted the growing complexities of global collaborations. A-6 argued that "*so little innovation is home grown. Unless you know the details behind a new product that is launched by one of the big companies, we just don't know what part Canada played in it".*

Measurements of innovation however were offered. They included: research publications; corporate culture; economics; human resources; funding; and intellectual property rights.

<u>Research publications</u>

While A-1 and A-6 identified publication in peer reviewed journals as a measure of innovation, they approached it from differing perspectives. A-1 simply noted that the *"ability to publish in peer reviewed journals"* is a legitimate measure of innovation.

A-6 however was sceptical about the real value of publication. He argued that while one measure of innovation particularly from the research perspective is the number

of papers that are published, *"the mark of successful innovation is not to be published"*. He provided an example of a specific journal pertinent to the food system. He argued *"that's where we publish the technology failures. If the innovation is successful, then the technology is patented or implemented in some manner … but the research isn't published".*

Corporate culture

Measuring corporate culture is a critical measure of innovation in the view of A-3, A-4 and A-5. A-4 identified the specific components of culture that *"provide challenges for your employees. If you want to be successful* [with respect to innovation] *you need to offer challenges to your employees".* He also included within this measure *"developing and rewarding people … and ensuring that employees have opportunities for personal satisfaction".*

A-3 supported this notion and argued that *"the environment for innovation and innovation behaviours"* are critical measures of innovation. These components are captured within the sphere of developing, implementing and sustaining a corporate culture that allows innovation to flourish.

A-5 echoed these sentiments and stated that corporate culture must be one that allows the employees *"the freedom to operate … they* [management] *need to hand over the power and responsibility and the freedom to make mistakes".*

Economics

A-4 and A-5 both immediately identified economic outcomes as the critical measure of innovation.

This measure can be achieved through *"providing benefit to the bottom line of a company or organization … growth"* (A-4). While A-5 supported the notion of contributing to the profits of the organization, she qualified her argument by noting that *"the innovation must be on the market or in use without having been pulled for at least two years – so it's sustainable profits that are required as a measure".*

Human resources

The ability to attract required *"knowledge workers … the right people such as leading researchers and innovators"* (A-4) is another measure of innovation. A-4 explained that many Canadian organizations, and particularly those on the prairies, have

difficulty in attracting the required knowledge-based human resources. Additionally, when they accept positions with the organizations, they often leave and move to other locales that offer less extreme weather conditions when the opportunity arises.

Funding

Similar to the view expressed by I-13 above, government funding is sought not only from industry but also from academia for research purposes. *"The ability to get a grant"* was identified as a measure of innovation by A-1. While universities use external funding support for research as an innovation measure, A-1 cautioned that *"whatever money is available, that's where the research is focused. As a result, universities are short-changing the public purse".* The rationale for this statement is that researchers may not be working in their specific area of expertise or interest. As a result, the research analysis may not provide the insight that could arise from research conducted in an area in which the researcher has passionate curiosity.

A-1 also discussed the ability of the university researchers to gain funding support for research from private companies. He noted that while private funding sources must be disclosed to the university, it is still considered a measure of research and innovation. His concern however is that while universities are pleased with external funding support for research, *"what I need is new facilities. We don't have the facilities that are required to do the proper research. Food and nutrition just don't have the clout of molecular biology or the others. It doesn't have the cache to attract the big money for proper laboratories. The university wants big payoffs so they don't care about food and nutrition".*

Intellectual property rights

Finally, A-6 identified intellectual property rights as a measure of innovation. Specifically, he targeted patents filed *"but more companies are now going down the road of proprietary information".*

A-1 and A-2 provided some final thoughts regarding measurements. A-1 argued that the measurements should include linkages which in his view they currently do not. He explained that *"whether it* [changes in measures] *happens or not, there needs to be a link among agriculture innovation, food innovation and health innovation".* He argues that the linkages should be a measure in the future.

A-2 summarized his thoughts on measuring innovation by arguing that measurements ought to change over time *"as we get more of an intelligent understanding of it* [innovation] *… If someone knows how to do it, I'd like to see how".*

5.2.4 Innovation measures actor group: government

Five of the six government interviewees responded to the research question of innovation measurement. When asked if their organization had innovation objectives each interviewee interpreted it from their own department rather than the government in general. The responses indicate that there is no consistency in government in this area. G-1 and G-6 stated that their departments do not have innovation objectives. G-3 was unable to provide a coherent response to the question. G-2 and G-4 each provided affirmative responses but with qualifications.

G-2 stated the approach his department has for innovation is the establishment of linkages among the various government departments at the Assistant Deputy Ministers' level. G-4 observed that his department has innovation objectives but predominantly entail the areas of research and development and management. *"It's more about process and being more effective in transferring technology that has been developed by Industry Canada … to push the scientific bounds by providing awards and funding to scientists … there really is no line item about innovation, but it's implicit"* in his department.

Another example indicating that measures of innovation are not consistent in government was offered by G-1. He noted that he was unable to identify measures of innovation by stating *"we haven't got that one figured out yet. We have directions such as excellence in science, public/private collaborations and others; but as for measurements, we just aren't there yet. But we're working on it".*

G-2 also had difficulty in identifying measures of innovation, generally or specifically. While he described certain activities that were occurring within government such as *"external reviews of the department"*, in the end he stated that *"innovation measurements are in development".*

G-6 as well discussed the difficulty of measuring innovation within government. She wondered if the question should be <u>who</u> measures innovation rather than identifying what the measures are. She explained: "*Even within my own organization, senior* [management] *measure it differently.* [Director]-*X would measure it by how much*

money the program has given away in any given year … [Director]-*Y would measure it in the longer term and measure how many new technologies were developed, new companies established, new markets entered. We don't even have an agreement in our own organization, and innovation and technology development is part of our mandate. The problem is that we have no formal measurement".*

Only G-3 and G-4 identified measures of innovation interestingly from opposing perspectives: inputs; and outcomes. G-4 also identified tolerance for risk as a measure.

Inputs

Inputs were identified as a measurement tool for innovation. G-3 first identified "*a good supply of bright people … an educated citizenry".* He continued his thought process by arguing that by measuring the following inputs, it is possible to measure innovation of the nation (note that he chose to jump from innovation in his department to innovation of the country, clearly struggling with the question with respect to his own organization): *"measuring the capacity and capabilities of the research community; measuring the competitiveness and growth of industry; measuring the growth and success of technology parks; measuring the procurement of innovative technologies by government – the largest purchaser of many innovations in the country".*

Outcomes

Consistent with industry, G-4 argued that the predominant innovation measure is "*economic outcomes for the country"* (although industry interviewees identified their own economic outcomes). With respect to his specific department, he noted *"the number of companies supported"* is a measure. He noted that his department uses *"econometric models. It's important to generate statistics to prove the public investment made in"* his department.

Risk tolerance

The level of tolerance for risk in an organization or country was also identified as a measure of innovation. G-4 argued however that currently the lack of risk tolerance from the current government perspective inhibits innovation in Canada. He stated that *"the issue is that the current government does not tolerate risk. The pendulum has swung the other way. And it* [current Conservative government] *is still demanding more improvement. There have been too many scandals but there is*

now a need for balance. The current situation is suffocating which has resulted in a downward drag on innovation capacity in Canada".

With respect to the future, measurements will be *"more institutional. The focus will be on the ability of global value chains to compete. It will be focused on competitiveness and profitability. It can likely be done right now through an academic process, but it can't be purely academic. We need real processes that measure competitiveness and profitability in a practical manner to know if our efforts are paying off. The problem is that innovation efforts can take a long time … But politicians think in the four to five year time frame. So any long term policy needs to be broken into short, medium and long term with a heavy emphasis on the short term objectives and outcomes"* (G-1).

5.2.5 Innovation measures – actor group: non government organization

The two representatives of NGOs responded to the question regarding innovation objectives in their organization. NGO-1 responded that his company does indeed have innovation objectives but they are in relation to working with companies that they perceive to be innovative.

NGO-2 stated that his company does not have innovation objectives or goals. He did comment however *"we're trying to understand innovation … but it's all a matter of securing the funding for undertaking the research"*. This thought is reminiscent of those expressed by I-13 and A-1 – dependent on external (and often government) sources of funding.

With respect to measures of innovation, the two interviewees identified statistical, economic and social measures.

Statistical

NGO-1 responded with respect to measures for his own organization. Since the innovation objectives involve assisting companies, he identified statistical measures such as: "the number of companies we assist; the number of times I am quoted in an article or am interviewed; the number of committees and government consultations I do; the number of trade shows we support; and the number of conferences we host or collaborate on". Note that the federal and provincial funding for this NGO whose focus was the bioeconomy was not extended and therefore ceased operations in 2009. Its parent organization however continued focusing on innovation in healthcare.

Economics

NGO-2 stated that his responses were in relation to the food system in general rather than his organization since it does not have specific innovation objectives. He noted that "currently innovation is measured in economic, measures: gains in GDP; number of products; number of jobs; number of farmers still on the land". He then argued that other measures must be found which led him to discuss social measures.

Social

NGO-2 argued that other measures must be found to measure innovation with respect to the entire food system. Social outcomes in his view are equally as important as economic measures. "While this measure may be difficult to pinpoint specifically on food choices … they can be measured along with lifestyle changes with the right research. The issue is that the outcomes may be in the long term but that shouldn't mean we should abandon that goal". His concern is that the political environment demands objectives be measured within a political mandate of four to five years.

NGO-1 supported that view and believes there will be support for social measures in the future. He argued that the measures will *"be increasingly linked to societal factors rather than economic factors. Economic measures will always be important, but society will demand different measurements – ones that address social issues".*

5.3 Conclusion

This chapter reviewed the findings of research questions two and three: What is driving innovation in the FFNHP and food segments? How is innovation measured?

The findings indicate some commonalities across actor groups as well as some distinction with respect to key drivers of innovation. The most common driver identified was the innovator, or the mindset of the innovator. This driver is significant as it was only one of two drivers identified by interviewees in all actor groups. This point continues the theme of one of the key characteristics of the concept of innovation identified in the previous chapter regarding the innovator and his/her mindset.

With respect to measuring that mindset, it appears that the various actor groups look at outcomes such as the number of new products, publications or contribution to the economic health of the organization. The question is whether that is a fair measure

of mindset or the innovator. It may be a better measure of an entrepreneur than an innovator.

The other common driver was economics or shareholder value. This driver focused on increased profits, reduced costs, the ability to secure financing or funding, and increased gross domestic product of a country. The term shareholder value was used primarily by industry. This point acknowledges that companies require outside financing to sustain themselves during the pre commercialization stage and into growth and maturity. It is also consistent with one of the key measures of innovation described by the interviewees during the field work.

Industry alone identified corporate social responsibility (CSR) as a driver of innovation. This finding was unexpected. It may imply that industry sees CSR as a business opportunity or a responsibility. Further research is required to make any valid conclusion. It was expected however that the government interviewees would view CSR as a key driver. The public interest is at the heart of the government, therefore the identification of social responsibility or CSR was expected. CSR however was flagged as being an important future measure by them.

Another conclusion of this chapter is that government policies and programs with respect to innovation may be counterproductive. The identification of government and government policy is perceived as being a key driver of innovation by industry and research/academia actors from the perspective of the programs that offer funding for company activity and growth as well research in specific areas. Government policy with respect to the regulatory environment however is perceived by them to be a drag on innovation. This conclusion indicates that government departments may be working at odds with each other regarding innovation.

Another key finding of this chapter is consistent with the previous chapter in that tensions exist within actor groups regarding innovation. Only one of four federal government departments has innovation goals, and only one of five academic/research organizations represented has innovation goals. While they indicated their organizations discuss innovation and see themselves as playing integral actors in innovation in Canada, they are clearly struggling within their own organizations as to what that means to them as an organization. This finding indicates internal tensions within the organizations.

The field work also revealed that less than half of the organizations in total (forty-one percent) have innovation goals or objectives. Industry is more likely than other actor groups to have set goals and objectives in this area. These goals or objectives may however be better described as commercialization goals or business goals which may or may not be attributable to innovation.

This conclusion is consistent with the key industry measure of innovation linking commercialization and the number of new products or economic outcomes. Not all new products however can be classified as innovative. And no one interviewee identified a measure of innovation as causing change or being a game changer even for proponents equating the concept of innovation with radical change. The conclusion is that if innovation is actually occurring within and across the actor groups in Canada involved in the FFNHP and food sectors, then the focus is at best on incremental innovation.

This chapter supports the findings of the previous chapter that show that innovation is complex and will become increasingly difficult to measure in the future due to the increasing number of domestic and international linkages. It will be difficult to measure what role Canadian actors played in innovation and how it can be measured.

The research also indicates that future innovation measures will balance social benefit outcomes with economic outcomes.

CHAPTER SIX – Interviewee perceptions: Innovation policy and policy implications in Canada

6.0 INTRODUCTION

> *"We need a national innovation strategy that is flexible and allows for companies in Canada to address emergent opportunities … Given the current atmosphere in Canada, we'll still be having the appetizer when … other countries are cleaning up after dinner".* I-1 Company president of a company producing food and functional food products

This chapter reviews the findings of the field work with respect to the research questions that address innovation policy in Canada. Analysis of the field work resulted in four core arguments.

The first argument is a lack of collaboration in the policy-making arena in Canada. As a result, there is no policy dialogue within or among the actors of innovation or understanding of how policy-making is undertaken in Canada currently. The perception is that policy-makers do not want input and therefore the policy-making process lacks transparency.

The second core argument flows from the first: policy-making in Canada at least with respect to innovation policy, is driven by the political arm of government. It incorporates little evidence and lacks a holistic approach required of the complex nature of innovation. As a result, tension exists among and within the actors of innovation and the policy-making arena.

A role for government is clearly seen as a requirement to facilitate growth in innovation particularly at the SME level. This third core argument is particularly relevant to the FFNHP sector that is comprised primarily of SMEs. These companies lack the resources to conduct innovation activities across the spectrum. Areas requiring government and thus policies and programming are capacity building, taxation, regulations and science and technology. With respect to regulations, the findings show that the current regulatory environment is a drag on innovation as it does not balance risk with the benefit given available evidence.

The final core argument is the need for capacity building within government. Policy-makers must not only focus on external actors, but internally as well. Analytical

capacity building is required within government in the area of understanding science and technology to better evaluate evidence for policy considerations.

The conclusion of this chapter is that government policies and programs are currently perceived as a drag on innovation in the FFNHP and food sectors.

6.1 Understanding of Canadian innovation policy

Only three of thirty-nine interviewees who addressed the fourth research question, knowledge of Canada's public policy on innovation in general or with respect to the FFNHP or food sectors, claimed to have good knowledge of it. G-1, G-4 (both government interviewees) and NGO-2 (a non government organization interviewee) claimed to have a good knowledge of the policy. I-2 and I-11 of the food sector, A-2 representing academia, and G-2 and G-3 representing government claimed to have some knowledge of it.

6.1.1 Policy understanding – actor group: functional food and natural health product sector

None of the FFNHP interviewees had knowledge of Canada's public policy regarding innovation. I-1 considers himself to be knowledgeable in this area and therefore argued that *"governments* [both federal and provincial] *have done a poor job at articulating them"* [innovation policies]. Furthermore he argued that *"policy gnomes in Ottawa develop policies in the back rooms. How do they know what we need? Who came around and asked our opinions on what was needed?"* In other words, he believes that he has not been asked to participate in any policy dialogue regarding innovation in Canada.

I-9 and I-17 believe that government did indeed conduct consultation. I-17 recalled *"sitting on some various round table discussions, but nothing ever really comes from any of them. I just don't participate anymore".* I-9 also discussed public consultations and the reports generated from such discussions. His observations are no less disheartening. In reference to the reports emanating from the consultations, he argued that *"they are just collections of information with some recommendations. The Members of Parliament argue a lot with each other rather than implement any long-term meaningful policy. They are too focused on the short term".*

I-5 also raised the approach of industry consultation by government. He argued that *"AAFC is too complex and unfocused. They call too many stakeholder meetings and*

it costs the SMEs too much time and money with no real positive outcomes. And I am not prepared to continue with this farce".

I-12 was the only other interviewee who expanded on a simple response of 'no' to the question regarding knowledge of Canada's innovation policy. She firmly stated *"no and I couldn't care less … no use for government programs and policies. My last encounters have not been pleasant ones".*

Impact of government innovation policy

Many FFNHP interviewees continued to discuss government programs which they have accessed to assist them in their own innovation efforts and the effects of the programs leading from the policies. I-12 continued her discussion regarding various programs. Her first example surrounded the National Science and Engineering Research Council's (NSERC) granting program. She stated that NSERC would not fund her innovative research into a specific area of health, *"so I self-funded and proved them wrong".* She gave another example of accessing the National Research Council's Industrial Research Assistance Programs (IRAP) which she stated was too onerous to administer for the amount of money received to assist her in developing new technologies. I-1 concurred with this viewpoint and stated that although his company used IRAP funding for innovation activities, he no longer accesses them due to the bureaucratic requirements. I-20 also identified IRAP as being *"a tremendous support in the early days of the company but the amount of time and work to access assistance now is just too much"*.

I-17 provided similar observations of government programs. He argued that *"everything right now in government is about CYA* [cover yourself]*. It's too much of a struggle for small companies. We can't continue to write reports and proposals like they demand. We don't have the time or the people to do it … Many of the programs require companies to submit paper, paper and more paper; and then it goes before a committee and then sits on a desk somewhere. Innovators don't have six months to wait for a decision. The government just doesn't understand innovators".* He also identified AAFC's Agri-Opportunities Program which he understands is meant to assist innovation. Due to strict program criteria, his company is ineligible to access funds. He argues that *"since I am a proven entity, a proven innovator, then I should be seen as a good investment of public funds".*

I-8 also expressed frustration concerning public programs in relation to innovation. He argued that *"they are not SME friendly. Programs are not accessible if research has already commenced".* He argued that an innovator will have commenced down the pathway of research prior to seeking funds. *"That's the nature of innovation. On top of that, one federal program cost five thousand dollars and another twenty-five thousand dollars just to apply. But SMES are not big enough to apply for this … the benefit goes to the larger companies who have the resources to apply".* He continued that *"there is no benefit to innovation policy except that we received an innovation award* [from government], *something we had no assistance from them in doing – but it looks good for them from a marketing perspective".*

Three FFNHP sector interviewees identified the Scientific Research and Experimental Development (SR&ED) tax incentive programs, a joint federal/provincial program, as a positive policy outcome that assists innovation. I-1, I-16 and I-19 all identified their appreciation for the program. I-19 argued that *"these programs are particularly good for SMES. It helps the cash flow. It's extremely helpful but the money doesn't flow for a year and a half. It would be great if it would work like the GST* [Good and Services Tax] *on a quarterly basis".*

While FFNHP interviewees were drawn from across Canada, interviewees identified only Alberta programs (other than shared tax incentive programs) as assisting companies in innovation. I-16 and I-20, representing Alberta FFNHP companies identified programs such as AVAC Ltd., the Alberta Ingenuity Fund, the Alberta Heritage Fund and the Forefront Mentorship Program and the *"TPC program"* [Technology Partnerships Canada which was incorrectly identified by the interviewee as provincial but is a federal program]. The companies have used the programs to build capacity both from an infrastructure perspective and human resource capacity. Both companies employ a significant number of highly qualified people. I-20 stated that the programs allowed her company *"to grow our own talent. It's low risk that way. The availability of support from the provincial government is the key reason I returned to Alberta and the reason the company stays here. Alberta is head and shoulders above all other provinces because of scholarships and support for HQP* [highly qualified people]*".*

Although not from Alberta, I-1 also identified funding from Alberta that assisted his innovation activities. He accessed *"some Alberta funding to conduct research at a*

pilot plant in Alberta" to prove his innovation would *"be a benefit for the farming community in Alberta".*

Again the issue of the Canadian regulatory environment was identified within the realm of policy and its effects on SMEs and MNEs. I-6's company benefited from the regulations *"but only because of an unintended consequence. Health Canada's ineptness resulted in making it difficult for EPAs* [eicosapentaenoic acid] *to claim anything, giving Omega-3s the benefit. From a luck perspective, the regulations actually helped us … The regulations however are very unclear. Policy-makers are writing policy that they know nothing about … Very few companies with the exception of Canada Bread can do innovation in Canada and make it pay".*

I-5 also addressed the issue of the current policy environment with respect to innovation. He argued, *"Health Canada overrides all else … has affected the SMEs and large food companies alike. SMEs are faced with entering a system with innovative products and emerging science where companies often don't know what they are going to find – what the results will be – or they don't know what will be asked of them by the regulators. The rules of the game are unclear. Where is the motivation for companies to be innovative? … Policies need to be clearer. Right now it can only be termed a tragedy. The regulatory environment is speculative at best. There is no real place for innovation in this industry but Canada is rich in research and development and our HQP. But there is not enough mind space in Health Canada for this. Have we ever seen a society in more need of functional foods and natural health products because of an aging population and obesity epidemic? Health Canada has had the same representation for too long. There is no change in mindset there and until there is, innovation will not flourish".* I-5 addressed innovation with respect to another government department as well, AAFC. He argued that *"AAFC has not bridged the gap to other departments. Collaboration is needed to address innovation but AAFC is insular. They have seven ADMs* [assistant deputy ministers – interview conducted in spring 2008]. *There are too many arms of AAFC … They can no longer operate in silos".*

I-1 wished to add some final thoughts regarding the impact of government policy on SMEs *"and other damage inflicted by the government on innovation".* He addressed three distinct points: 1) the dismantling of the Office of the National Science Advisor; 2) elimination of core funding for infrastructure; and 3) access by MNEs to Canadian publicly funded research.

I-1 views the dismantling of the Office of the National Science Advisor in Canada in 2008 *"as communicating a very bad message internationally concerning science in Canada. Science and innovation are going to return to a political agenda rather than a national agenda".* He argued that this approach by the Conservative government will damage Canada's reputation and country ranking in innovation.

Secondly, I-1 noted that he sits on several Boards of Directors of organizations operating in or serving the food system in Canada. He noted that the government has cut or severely reduced core (operating) funding to several contract research and development organizations that serve the industry, such as POS Pilot Plant and the Canadian Light Source (Canada's only synchrotron). Other funding programs previously available to SMEs allowing them to access the services of the contract organizations have also been eliminated or severely reduced. The impact is that only MNEs or large companies can afford to pay the full service cost of these valuable infrastructure organizations. They are *"all but inaccessible for the SME".*

Thirdly, I-1 argued that current policies allow "*publicly funded research to be exploited by global companies"* and therefore do not add to the GDP of the country. *"In some instances Ag Canada* [AAFC] *has even barred some Canadian companies and investors from viewing their research as they* [companies and investors] *do not meet certain criteria. The only companies that could meet those criteria are the MNEs – returning only licensing fees back to Canada … So the only entities that appear to have benefited much from the innovation policies are the MNEs".*

6.1.2 Policy understanding – actor group: food sector

Two of the nine food/retail interviewees, both representing large Canadian food companies, claimed to have an understanding of Canada's innovation policy albeit divergent views. I-11 stated that the policy *"is all wrapped up in Canada's tax support program"*. I-2 argued that he is familiar with the policy in general and as it pertains to the food system. He argues that *"it all sounds the same. There is government commitment to it but it is NEVER* [his emphasis] *turned into action".* His view of lack of action on the part of government is consistent with those expressed by I-5, I-9 and I-17. I-25 added his voice of concern over consultation and inaction. While he is not familiar with the innovation policy he does *"remember being part of a number of meetings … Government is good at seeking industry input but it never leads to anything concrete".*

I-2 continued his view on Canada's innovation policy by noting that *"the vast majority of Canada's innovation policy effort is focused on the university system – on research and development and developing HQP".*

Three food sector interviewees identified government programs that their companies had accessed. They each linked these programs to innovation. R-1 discussed the collaboration his company has had with a researcher at the University of Toronto. The researcher *"was the driver behind"* one of the company's new brands that is focused on a specific health benefit. He stated that the government matches his company's funding of the researcher. He also noted that his company has a *"full-time regulatory affairs person who keeps track of the different ministries. The person reports to senior management. But a smaller company just wouldn't have the capacity to do that".*

I-13 stated that his company uses IRAP funding to assist in the development of some innovative technology. The company also *"deals with the environment and agriculture departments … but none of them seem to talk to each other. There are overlapping programs … but there appears to be a territorial culture with the government departments which takes time and resources to figure out what's really going on in government, something small companies don't have".*

The company represented by I-11 has used many government programs over the years but *"we're getting away from them – except for the SR&ED program because getting government money or help is just too tough and time consuming".* He then questioned Canada's Science and Technology Policy (the new policy document replacing the previous innovation policy). He argued that Canada's policy, rather than focusing on economic outcomes should focus on social outcomes which are consistent with Canada's culture. *"Canada cannot have the goal of supporting the growth of the GDP because it's counter cultural to Canada. Innovation involves risk and we don't have a risk-based population. We aren't wowed by innovation like the Americans and so we aren't pre-programmed to be innovators".* He argued that Canadians however could and would *"buy into innovation that supports human and environmental health which is more social based … Policy and innovation are like opposite poles in a magnet. They are rarely pulling in the right direction together".*

6.1.3 Policy understanding – actor group: research/academia

Five of the six research/academic interviewees stated that they were not familiar with Canada's innovation policy. A-2 was the sole interviewee in this category to claim to *"have seen most documents"* with respect to government policy in innovation so was *"vaguely"* familiar with it. He then immediately decried the closure of the Office of the National Science Advisor by the Prime Minister, similar to the point made by I-1. A-2 argued that *"the office was useful in promoting innovation and measurement".*

A-2 includes agricultural innovation as part of his area of interest. He argued that *"in agriculture, public policy has been reasonably effective. AAFC scientists have worked with farmers. But more recently, government has done a dismal job overall across the sector. Government appears to have withdrawn from working with industry. The NHPD* [Health Canada's Natural Health Product Directorate] *doesn't do a good job either. It lacks resources to meet its goals. The backlog is unbelievable. Why would a company even want to be in Canada"?* Government has invested in Canada Research Chairs at universities *"which has been very good from a research perspective".* A-2 continued to argue however that government expects industry to take the lead from an applied research perspective *"but isn't putting in place the incentives … With food and health, government needs to be in there with both feet but they have done a dismal job".*

A-4 also offered his views on public policy. He stated that while he is not familiar with public policy regarding innovation, he has read the policies. *"but I can't spend a lot of time looking at them because I know nothing will happen – nothing will be implemented … I don't think innovation is important to them* [in this instance he was referring to AAFC]*".* Similar to previous opinions expressed by interviewees, A-4 argues that *"public policy has not enabled innovation and in fact has inhibited it in the FFNHP sector because of the regulatory environment".*

A-4 and A-6 both observed that innovative Canadian SMEs are being purchased by MNEs who then move company research and development activities outside of Canada. Their view is that Canada is then not given credit for the innovation that has occurred in the country. Taking it a step further, A-6 argued that *"our innovation policy doesn't take in to consideration that Canada represents a branch plant environment".* Although he claimed not to be familiar with the policy, he identified that many companies have either moved or been moved out of Canada to *"more favourable environments and bigger markets".*

6.1.4 Policy understanding – actor group: government

Only two government interviewees, G-1 and G-4 representing different departments, stated that they had a good knowledge of public policy as it relates to innovation. G-4 explained the process undertaken to develop the Conservative government's Science and Technology policy which had replaced the previous Innovation Policy. He argued that *"there really is no innovation strategy or policy. What does the current S&T* [Science and Technology] *policy mean? There is no foundation and little substance. It just isn't well thought out".*

G-1 expressed a similar view. He argued that the federal Science and Technology strategy was *"driven by a few influential people in government and now it's applied government wide … there is a lot of interest and confusion in the innovation area. The policy direction depends on the definition and I'm not sure we all agree on the definition of innovation".*

In response to the impact policies have had to date on innovation in Canada, G-1 argued that *"there's been too much focus on the parts – focus on industry – focus on government activity – focus on research – but no collaboration. They are not working together on a suite of actions … a coordinated plan of action".* A *"focus on the parts"* may continue. G-4 is of the understanding that the major focus of government policy with respect to innovation, science and technology will be on the universities *"which is a big mistake. It must be a coordinated plan of action".*

G-3 appeared vague about his knowledge in the area of government policy on innovation or the Science and Technology Policy although he claimed to be very familiar with it. When he was asked to briefly describe it, he suggested the researcher *"get a copy of it and read it"*. Due to his evasive answer, it was unclear as to whether he was actually familiar with the policy. When G-3 was asked how government innovation policies have impacted industry, he stated the *"number one indicator is increasingly considered to be productivity … what you've asked is very difficult to measure … And at the end of the day, innovation is all about the extent of investment that you have been able to attract".* He was unable or unwilling to expand on his response or hazard a guess regarding the extent of investment made in Canada based on government innovation policy.

G-6 stated that she had no knowledge of the policy but wondered if anyone other than the policy-makers who developed it actually were aware of the policy. *"BUT* [her emphasis] *just because you don't know about it, doesn't mean anything. If policy-makers have done their job, we will be impacted by that policy and we should know the impacts. THAT* [her emphasis] *is the most important thing".* She was unable however to articulate if or how the innovation policies have impacted SMEs or MNEs. *"I have no idea. It's still a debate because everyone is measuring innovation differently, even within our department".*

G-2 stated that he is *"just vaguely familiar"* with Canada's policy as it relates to innovation. He believes that the policy *"defines innovation and sets quantifiable targets. It also states the criteria for support for innovation".* With respect to impacting the FFNHP sector he argued that *"the sector is just too new that there really is no impact right now".*

6.1.5 Policy understanding – actor group: non government organization

NGO-1, the first of two NGO interviewees stated that he is not familiar with Canada's public policy with respect to innovation *"but am much more familiar with the policies in the U.S. as that's where we promote most of our companies. The market, the competitive environment and of course, the FDA are much easier to deal with".*

NGO-1 provided observations regarding policy impacts he noticed on SMEs or MNEs with which his organization has worked. He stated that many of the companies access the SR&ED tax incentive programs that are jointly offered by the federal and provincial governments. He argued that while the programs have benefited small companies *"it helps the bigger company more because while it assists with cash flows, the benefit does not come back to the company for a year and a half. That time can make or break a company that's in its infancy stage and early start up".* Similar to I-19, he argued that the tax incentive would be more beneficial if paid to companies on a quarterly basis.

NGO-2 stated that he was familiar with the innovation policy *"but it's now the Science and Innovation Strategy".* His understanding is that the strategy is *"to build capacity in science and technology in Canada through emphasis on research in universities … educate more researchers who will then work with industry. The strategies attempt to link with industry so that when new discoveries are made, the industry will commercialize the results".*

NGO-2 argued that the benefit of the strategy will be to the larger companies since *"they have the ability to work with universities and also do in-house research. They have the vision. The difficulty with the SMEs is that they often don't have the capital to bring new products to market and gain the ear of the politicians".*

6.2 Enabling policy environment

The final research question was then addressed. The interviewees were asked to address the general questions of the kind of policy framework that would assist the growth of innovation in SMEs in Canada in the emerging FFNHP sector. Specifically, they were asked to identify public policies that would assist each interviewee's organization in being more innovative. Table 16 on the following page provides an overview of the responses with further explanation following the table.

Table 16: Innovation policy direction in Canada for functional food and natural health products' sector

Policy area	Program focus	Description	Government role
Capacity building	Collaboration (1) (2) (3) (4)	1. Partnering with research organizations 2. Partnering with industry 3. Facilitating networks and relationships across actor groups 4. Conducting policy dialogues with all actors 5. Educate public and gain public trust 6. Establishing and participating in international research networks 7. Multi-government partnering (e.g. Health Canada and provincial Departments of Health) 8. Increasing commercialization know-how in all actor groups	• As facilitator • As partner
	Human resources (1) (2) (3) (4)	9. Accessing highly qualified people 10. Accessing highly seasoned people 11. Supporting mentorship 12. Building internal capacity (supporting human resource knowledge growth from within companies) 13. Increasing scientific and technology knowledge and analytical capacity within government 14. Educating students in creativity and entrepreneurship (developing new educational model)	• As funder • As partner with provincial education ministries
	Infrastructure (1) (2) (3) (4)	15. Ensuring industry access to contract research organizations 16. Building regional clusters that include business incubators, research incubators, research stations, pilot plants 17. Ensuring university laboratories are accredited	• As funder • As leader and partner in cluster building
Taxation	Scientific Research and Experimental Development (SR&ED) (1) (2) (3)	18. Expanding the program for both private and public companies 19. Shortening the time frame for payback to companies	• As policy-makers

Regulatory	Functional foods and natural health products (1) (2) (4)	20. Ensuring a balance between safety and benefit (make regulations more proportionate) 21. Providing funding for clinical trials 22. Making the regulatory process more responsive to industry (more timely responses)	• As regulator • As funder
Science and technology	Licensing (1) (3) (4)	23. Developing criteria that allows Canadian SMEs access to research conducted at publicly funded institutions 24. Increasing funding for basic research 25. Decreasing government investment in science and technology at universities 26. Investigating balance of investment in science, technology and innovation in all actor groups 27. Initiating and securing evidence for policy-making 28. Developing technology platforms 29. Expanding time frame for expected outcomes of research programs	• As facilitator (particularly for commercialization in early and mid stages) • As initiator and funder of evidence • As leader in research and development
Paradigm shift in policy-making	Change (1) (2) (3) (4)	30. Needing new vision that includes all actors 31. Needing holistic approach to policy-making (across government departments) 32. Needing action and belief that action will happen 33. Needing institutional change 34. Needing focus on health promotion and health prevention rather than only treatment 35. Needing translational nutrition	• As agent of change

(1) Industry, (2) Academic, (3) Government (4) Non Government Organization

Secondly, they were asked to identify the triggers that would lead to the new policies they are suggesting.

6.2.1 Policy environment – actor group: functional food and natural health product sector

The seventeen FFNHP sector interviewees identified five public policy areas, one of which was an approach to policy-making. The policy areas in descending order of support were: capacity building; programs; regulations; policy shift; and access to publicly funded research.

Capacity building

Ten interviewees addressed the need for policies that address capacity building in the following areas: collaboration (I-5, I-6, I-7, I-15, I-18); human resources (I-1, I-14, I-17); and infrastructure (I-1, I-12, I-18).

I-18 and I-6 identified the need to partner with other companies and researchers. SMEs are particularly vulnerable and have limited resources to develop collaborative activities and see the government as being the facilitator for collaborations. I-6 specifically argued *"more focus needs to be provided on giving SME support in the area of collaboration with other companies and researchers both in Canada and outside of Canada. Research is becoming so specialized that you can't possibly find the scientists needed in all areas in Canada".*

I-7 identified the research community however as a particularly difficult actor group with which to collaborate. She argued that the government could take a leadership role in collaboration. *"Nobody works together in this country. Nobody knows how to collaborate. The research community here doesn't have any idea about how to collaborate with other regions where other expertise is. Researchers are not interested in knowing what big food companies need. The government could pull all stakeholders of innovation together".*

Health Canada was identified as a specific government department where collaboration is required between government and industry. I-5 believes that *"innovation will only flourish in this industry when Health Canada is engaged with the sector".* I-15 concurs with this view. She represents a recognized innovative company and sees the benefit of collaboration with all actor groups including Health Canada. She targets collaborative efforts however in educating the public and gaining their trust. She wondered *"I just don't know how we got into such an adversarial position that we're in right now. Nobody is benefiting. Health Canada is just operating in a culture of fear. Why don't they see themselves as a partner in a healthy Canada?"*

I-14 however argued against any policies that encourage or force collaboration. His company was *"strongly encouraged"* by government to participate in a collaboration with government, researchers and industry. He argued: *"What's the incentive to network with our competitors? We can and should think our way out of our own box. We want to be quiet as a corporation".* Note that the interviewee represents a company that has been long established in Canada and was recently acquired by a large international firm based in the EU.

Interviewees also argue the need for capacity building in the area of human resources. I-1 cited the need for support for accessing highly qualified people (HQP) with experience which he deems to be *"desperately needed in the sector. The FFNHP sector is primarily comprised of SMEs in this country and we can't afford to train new graduates".* He argued that funding to train *"interns"* would assist companies in building internal capacity in this area.

The cost of HQP can be prohibitive. I-14 argued that *"accessing HQP is difficult given the complex and narrow scope of the company's area of specialty … But in the end, it comes down to how much you can pay them. The competition for good people is so fierce".* His company has benefited from university co-operative programs where on-site training is part of the education of the new scientists. They are then able to hire the new graduates. I-17 argues that food scientists trained under the current university system *"are too technical and too much about process. They don't use their left brain which is the creative side … That's what I need".*

I-17 continued however that the real need for mentorship is in the area of business acumen. *"The government needs to give support to the innovator to help them move forward … Young entrepreneurs are starving for help on how to build a business".* He argued that the government could build capacity in entrepreneurs and support innovation by hiring experienced or retired people. *"We need to be able to use the grey haired people. These are the people who will challenge the young ones".* He added that the experienced people also bring value in their networks with which the young entrepreneurs could link.

Four interviewees (I-1, I-6, I-12, I-19) also addressed the need for support for infrastructure. I-1 argued that support must be provided for large contract research organizations to allow them to be accessible to SMEs.

I-6 argued for the need to build food clusters which *"will result in critical mass that attracts innovators, HQP and scientists who will collaborate on various projects. Canada needs more of a food industry before the FFNHP sector can thrive. Right now, we don't have one".* As well, she noted that some of the university food science departments are not accredited by organizations deemed necessary with some buyers (e.g. certified by Institute of Food Technologists). Companies therefore are reticent to use those laboratories and seek assistance in other regions, her company being one of them.

Access to business and research incubators is also deemed beneficial to enable innovation. Both I-12 and I-19 discussed the high cost of such incubators. They also noted that these incubators are publicly funded but still beyond the realm of SMEs. I-12 argued that she *"would like laboratories that can be used by company researchers that don't make me pay thirty to sixty percent administrative fees like the government and universities do".* I-19 supported this argument noting the need for *"science and business incubators".* While she acknowledged that some incubators are currently available, *"they aren't helpful for entrepreneurs because they're just too costly".*

Programs

Almost seventy-one percent of the FFNHP interviewees (I-1, I-3, I-4, I-8, I-9, I-14, I-15, I-16, I-17, I-18, I-19, I-23) equated the question of government policies that could assist innovation with government programs. Interviewees commented on specific programs or the application of programs.

As stated in previous sections, I-1, I-16, and I-19 support the SR&ED tax credit program. Five other interviewees joined in support of the program: I-4, I-9, I-14, I-15, and I-23. They noted that the benefit assists a company's cash flow, although several interviewees noted that the lag time of approximately eighteen months between submission and payment is too long for SMEs and *"the newer companies"* (I-9). The interviewees noted that the cash that flows back to the company allows it to continue with research (I-1, I-15, I-23) or access HQP. I-14 noted that the SR&ED tax program *"is a fantastic financial benefit that allows us to hire HQP".*

Privately held SMEs appreciate the program. But I-16, President of a publicly traded company, argued that the SR&ED tax credit program must expand its scope to encompass publicly traded companies.

As well, I-1 cautioned that while the credits *"are good, they are cumbersome – too much paper work for a small company so it benefits large and MNEs more".* He argued that the *"post Gomery[6] era has negatively impacted government and small business throughout Canada. Programs are more administratively a headache and the public servants who run them are unable or afraid to make decisions on their own. These programs need to be made easier to access if they're going to have any effect".* I-8 and I-3 agree with the need for the programs to be more accessible for SMEs. I-3 also spoke to the lengthy bureaucratic process related to government programs. His experience is that *"they're too onerous for the industry to use. It's just too much effort to fill out the forms and report on an on-going basis. How many people do they think I have working for me?"*

I-19 pointed to the need for more programs that assist SMEs such as in the United States. While unable to identify specific programs there, she stated that the National Institutes of Health in the U.S. and other programs provide funding for up to twenty million dollars to undertake clinical trials. She argued that *"if we're really going to be serious about health prevention … then we need assistance for substantiation purposes".*

In the view of some interviewees, analytic capacity building within government is required. They argue that knowledge of innovation and specifically this sector is missing in program delivery. I-18 argued that public servants administering programs have little understanding of innovation or technical information regarding the sector. *"They don't understand the issues facing them and how to best deal with them".* I-15 agrees. She argued that *"government needs knowledge and capacity to understand the science. Public servants should have … basic knowledge of the science with access to resources".*

I-7 identified an additional issue arguing that while programs are developed by government, they are often not implemented leaving SMEs' hopes and expectations dashed that there will be assistance. She explained that *"the government only wants to score political points … Media events are organized to announce new programs but then they don't cough up the money. Those programs need proper criteria that are transparent and consistent across the country not just politically convenient".* I-1 also identified the issue of inconsistency of federal programming across the country. He gave the example of IRAP, a federal program. *"Why is it that I could get funding from IRAP if I lived in one region of the country but not in this region?"*

[6] Canada's Gomery Inquiry in 2005 examined federal government favouritism and waste with respect to a sponsorship scandal.

Regulations

While the regulatory environment with respect to functional foods and natural health products was raised consistently throughout the interviews, only six FFNHP interviewees (I-3, I-7, I-9, I-15, I-20, I-23) raised the point in discussions relating to policies that would assist innovation in their sector.

The main contention with respect to regulations surrounded the need for balance between safety and public benefit. I-15 articulated the position taken by the others by arguing that *"the regulations need to be appropriate and proportionate*. *There is too much focus on safety – too much caution – there needs to be more balance".*

1-20 expressed similar views to I-15. While her company currently targets the NHP market, it would like to develop functional ingredients. She stated *"but the regulatory environment is too onerous … the demands of the current regulations are in excess of getting drug claims. The regs* [regulations] *are out of proportion – the standards are too high – they need to change. The public is demanding it … even if we just tweak something and decrease obesity by one percent, we need to enable it. The risks are out of proportion to the potential benefits. What's the downside – if we're wrong and there's no benefit from the ingredient, then we've lost nothing".*

Unless the regulations become less onerous, I-23 argued that *"smaller companies will have an increasingly difficult time to get through the lengthy pipeline … only the bigger companies will survive because they are the only ones that will be able to sustain the length of time required in the proof process and then the approval process of the NHPD".*

Policy shift

Four interviewees (I-4, I-5, I-6, I-7) put forward the notion that innovation will be spawned if a fundamental policy shift occurs in Canada away from health care and towards public and population health.

I-6 suggested that there is *"need to change the government from a focus on sustainability of business to sustainability of health … Government has to make choices and it cannot have the pixie dust mentality it has had in the past".* I-7 was also of this view and argued that the policy shift needs to be an increased emphasis and effort on population health. *"What is really needed is a focus on translational nutrition and the government should take the lead on it".* When asked for clarification, she explained that translational nutrition *"is a multidisciplinary approach to nutrition that involves food, health and nutrition science to*

address diseases that are nutrition related". She therefore argued that public health should be of critical importance in policy-making. She continued that *"Health Canada regulates safety and efficacy but its mandate is also prevention. And it pays little attention to that ... Health Canada needs to accept responsibility for its mandate around prevention. The problem is that there is extreme paranoia in Health Canada about safety and efficacy … they need take into consideration evolving science and therefore they need to be flexible".*

I-4 agrees and notes that *"the role of government is to create opportunities to be and stay healthy. Canada could take a lead by impacting personal health … The focus needs to be on population health and public health rather than health care. That's what will drive innovation in the sector".*

If a policy shift were to occur, I-5 identified the challenge ahead for government. While he argued that a fundamental policy shift towards public health and away from (or less emphasis on) economic development is required, he noted the challenge it presents. *"The public service doesn't turn on a dime and therefore regardless of what the political wing wants, the public service can't change quickly. It's not a machine."*

Access to publicly funded research

I-6 argued that criteria to license research at government institutions much change. The current situation in Canada *"is ludicrous. Our technology is being licensed by some of the big companies and then it sits on a shelf while their more expensive products are being sold"* (I-6). Making the same point as A-6, she noted that the current criteria preclude SMEs from access to the research which they could commercialize. Innovation would increase in the country as the SMEs have the *"passion and determination"* to succeed.

Triggers for policy change

The interviewees were then asked to identify what might trigger the *"new policies"* they suggested. Five FFNHP interviewees (I-3, I-8, I-12, I-14, I-17) stated that they did not know what might trigger a new policy within government. I-17 added he did not know *"because I don't understand the current government environment of fear and covering yourself. It's not compatible with innovation".*

The remaining twelve FFNHP interviewees framed their triggers in three general areas in descending area of support: the actor groups affiliated with government; crisis; and competition.

The actor groups affiliated with government

The interviewees discussed the actor groups affiliated with government that in their view would trigger new policies: the people or the electorate; the politicians; and the public service. Note that the interviewees used the term government when referring to the political wing as well as the public service. The context of their use of the term indicated to which actor group they referred.

Five interviewees (I-4, I-5, I-7, I-15, I-20) identified the first of the triumvirate of the actor groups of government, 'consumers', 'the people' or 'the public', as the trigger for new policy. They argued that the demand for change begins with this actor group.

I-5 explained that *"the tipping point will be when the Canadian population recognizes the benefit … they will then force the politicians who will then be the apostles to make change".* I-4 agreed with the point and observed that *"government reacts to the flavour of the day of the people. There needs to be a groundswell of support for change in public policy on health."*

One interviewee provided an example of how action on the part of the people can result in change in policy. I-7 gave the example of how "*consumers were mobilized in the U.S. with the outcome of DSHEA* [the Dietary Supplement Health and Education Act of 1994]*. It's going to take the political route to get any change happening"*. I-15 concurred but added a cautionary note: *"and the real problem is that we don't understand the policy-making process so really how can we influence it. The public is going to be the real loser in all of this".*

Politicians were identified by several interviewees as either being the trigger for change or knowing what the trigger(s) might be. I-5, 1-9, I-16 and I-19 all suggested *"ask a politician"*. I-9 however pointed to the precarious position in which politicians often find themselves. He explained: *"but politicians must choose where support will be placed. It's impossible to support all sectors. While some specific sectors should be the primary focus, this must be balanced with some support for all sectors. Who knows where the next Apple* [reference to Apple Corporation] *will come from?"*

I-18, I-19 and I-23 agreed that politicians trigger policy change. They argued that a policy shift to health prevention or public health must be rooted in political recognition and policy direction. I-18 added that the politicians and public service must recognize that *"this industry has value and can contribute to a reduction in health care costs".*

I-16 added that political leadership will force change in policy direction. She provided an example of the leadership of the elected government of Alberta. She explained that *"government leadership can trigger change …. For example Premier Stelmach* [Alberta Premier] *is aggressive in his government's approach to innovation. And while they don't necessarily understand it, the province has generic faith that it will produce value for the province".*

Three interviewees, I-6, I-19 and I-23 identified the public service as a trigger for change. None of the three interviewees expressed hope for change in the near future however. I-6 spoke to the need for *"a change in mentality in the government".* She argued for the need for cohesion among government departments for any meaningful change in policy to occur. Her experience is that *"right now they say they do, but they really don't".*

I-5 also expressed concern regarding the possibility in change of policy and what the triggers might be. He added that *"right now, there is a strong perception from the farmer side that these* [NHPs] *don't result in any value for them – and in this country, the government focuses on the farmers … to make any changes, it's going to be tough".*

Crisis

I-7 was the lone voice of the FFNHP interviewees identifying *"crisis"* as a trigger for changes in policy. She cited the change in policies made in Finland as a result of crisis. She explained that change did not happen until a discovery was made that a high percentage of the Finnish population had heart disease caused by high cholesterol. Government, the research community and industry in that country collaborated to develop plant phytosterols. *"Everyone worked together to get the cholesterol of the country's inhabitants down – and with dramatic results in the health of the population. But it took a crisis before anyone would act".* She argued that *"Canada isn't at that point yet".*

Competition

Global competition was also identified as a policy trigger. This point was also raised as an innovation driver. I-1 argued that global competition *"will demand that Canada has new policies. If we start falling in competitive advantage rankings, then we will need new policies".*

6.2.2 Policy environment – actor group: food sector

To the question of what public policies would enable innovation in the FFNHP sector, I-25, President and CEO of a technology-related food company responded: *"That's a difficult*

question because as risk takers, innovators make everything up as you go along. There really is no set pathway. So how could you have policies that support that? They [risk takers] *like endorphin releases associated with crisis. So the best way to support innovation is cut off the phones".*

I-22, representing an MNE, and an American working in the U.S. but familiar with the food system in both the U.S. and Canada, was somewhat more philosophical in his questioning of public policies that could enable innovation. He argued that *"there is a huge disconnect between Ottawa and the rest of the country … it isn't unique to Canada. It's the same in the States. But I'm not sure that the disconnect is a bad thing. I have a strong mistrust of policy coming from government. In terms of safety, I have no trouble with their involvement. But enabling innovation – I don't know. If they have anything to do with it, companies will have all the innovation of a Russian apartment building … Government needs to stay out of innovation and let private industry take care of it".* I-22's observations were in distinct contrast to those of the majority of Canadians interviewed. It would be interesting to know the support he would receive for those opinions in his home country.

R-1 also expressed a concern about any government role in innovation. He argued that "*government policy usually inhibits innovation. Policy is usually on the tail end of trends. NHPs for example – they've been around a long time. Why did it take so long to regulate the sector? … Innovation is about living in the circle and pushing out the circle but government is all about living in a box".*

With the exception of I-22 due to his rationale noted above, the food/retail sector interviewees identified four public policy areas. Similar to perceptions of the FFNHP, the interviewees' responses to this question were broader than just policy areas. In descending order of support, they were: capacity building; programs; regulations; and policy shift.

Capacity building

Similar to the FFNHP interviewees, food/retail interviewees identified three policy targets in the area of capacity building that would assist companies in their innovation efforts: collaboration; human resources; and infrastructure.

Three food/retail sector interviewees (I-2, I-21, R-1) identified collaboration efforts required in various areas. R-1 referred to the necessity of collaboration among government departments. He believes that while government departments are beginning to work more closely with each other, *"the discussions have just begun. But it's a start. They* [government

departments] *need to work together to have a more holistic approach to policy-making … from regulatory, tax, investment, social policy, innovation and health all working together in an integrative manner".*

I-2 and I-21 were more inclusive of collaboration incorporating more than just government departments. I-2 argued that Canada requires a greater emphasis on collaboration rather than competition. *"There's too much talk from the Canadian government about the country's competitive advantage".* He offered an example of Japan's Ministry of Trade *"about twenty years ago. It was able to garner the support of Toshiba, Panasonic and other tech companies to work collaboratively in building basic new technologies for the greater good of the country. The individual companies could take those technologies and add value and then reap their own financial benefit … The problem is that the western world's attitude is on ownership not consensus. Our values do not lend themselves to collaboration and consensus. Our culture is too competitive and opportunities are missed".* His point is demonstrated by I-14's argument against collaboration with other companies.

I-2 also raised this point. He argued that if Canada is to have an impact in innovation in the food sector or the FFNHP sector, then policies must be developed that facilitate the approach of a common goal among actor groups. He argued that Canada has the passion for innovation but that drive towards competition is actually inhibiting it. *"Canada needs a collaborative approach to innovation and that will bring value to the SME".*

Capacity building in the area of human resources is also perceived as an area where government could assist. I-11, I-24 and I-25 believe this context is critical to enabling innovation. I-25 identified expertise and experience gaps in commercialization. In his discussions with other company representatives, he stated that human resources must be developed with these capabilities.

I-24 and I-11 addressed the educational system. I-24 argued that *"the education system that's currently in place is knocking the creativity out of the students. And it isn't just the educational system. Right from the beginning, everything is planned for children. Everything is structured. Kids have play dates now and parents watch over them to ensure everything is constructive. The issue in the long run will be whether all of this structure will result in less creativity and less innovation".* His point is consistent with the concern described previously by I-17 who argued that new university graduates are focused more on process than creativity.

I-11 also identified education as an area that requires support. He argued that *"education is going to be the cornerstone for increasing innovation activity in Canada … We need more people who can connect the dots. Innovation is becoming more and more complex and we need the people who can accommodate the complexity – connect the dots – adapt the technology. There are fewer opportunities to be truly innovative and it will take knowledge to do it".*

Programs

Interviewees identified government programs as assets to innovation. I-10, I-24 and I-25 each identified tax programs as providing benefit to companies. Similar to their FFNHP counterparts, I-10 and I-25, both representing Canadian food companies identified the SR&ED tax credits. I-10 noted that the tax credits *"have helped my company immensely … Seventy percent of the company's business is in the U.S., but unfortunately they don't have the tax credits such as this".*

I-10 also argued for programs that provide access to public funding to assist companies as they grow. His company borrowed $675,000 in the 1990s to start a food manufacturing plant *"and it's all been paid back. This loan was instrumental in allowing me to establish the company which is now the largest …* [reference to the company's food category] *manufacturer in North America. SMEs need money and if the concept is worthwhile, then public funds should be used so that these companies are protected from 'vulture' capitalists".*

Similar to the arguments put forward by FFNHP interviewees I-1, I-3, I-8, I-11 and I-25 argued for the need to streamline the reporting requirements of accessing government programs. I-11, representing one of Canada's largest food companies stated that he appreciates the need for due diligence on the part of government, *"but the expectations are too onerous. The energy required to keep government funding programs happy is getting insurmountable – and just imagine what it's like for the small companies".* I-25, representing a small company, concluded by arguing *"the government programs are too time consuming for small companies. There's just too high a cost to undertake these programs".*

Regulations

I-21, I-22, and I-24 all spoke about the regulatory environment in Canada but from differing perspectives.

I-21 discussed the process by which all products in the food system are approved in Canada and compared it to its American counterpart. While Canadian based, I-21 represents one of

Canada's largest food companies that also does a significant amount of its work in the U.S. He argued that *"something needs to be done about speeding up the regulatory process in Canada. It will shorten the innovation process. Currently it takes forever to get something approved in Canada. When you ask questions in Canada it only begets more questions. You never get an answer. It's tough to do business here. But the FDA says – 'here's what you have to do' and it allows you to cut through the time it takes for innovation to get to the marketplace … The regulators in Canada … need to get in stealth mode. Health Canada needs to be more engaged".*

I-24 providing the perspective of an MNE stated that he was *"aware that the nutrition sector in Canada is very concerned about the regulatory piece".* He argued that policy can *"play a huge role in innovation".* He provided the example of trans fat. Once government *"became involved in the fight against trans fat, the policy played a huge role in innovation and getting new formulations that affect taste".*

I-22, consistent with his previous arguments against government support for innovation argued that *"government needs to focus on food safety and let the market regulate the efficacy of a product. If it* [the product] *doesn't work, then people won't buy it".*

Policy shift

I-2 and I-21 believe that government should focus on public health. I-2 argued that *"public policy must support the greater good and increasing the health lifestyles of Canadians".* I-21 concurred and added that *"there is a societal cost to holding up good innovations. The government needs to promote public health and healthy lifestyles. They need to do a lot more about health promotion".*

Triggers for policy change

The food/retail interviewees identified three general areas that trigger policies: the actors of government; scientific evidence; and crisis.

The actor groups affiliated with government

Five of the nine food/retail interviewees, I-2, I-10, I-11, I-13 and I-22, identified the role of the public in policy development. These interviewees argued that policy development is triggered by *"public opinion", "the electorate", "the voters" and "the grassroots".* For example, I-10 noted that *"A grassroots movement that demands change"* can trigger new policy but *"as Canadians, we are an apathetic populace. Consumers – voters – don't realize their power".*

I-2 however noted with caution the power of the electorate. He argued that *"the will of the electorate will trigger new policy but the issue is that the electorate is often fickle and will change".*

I-22 and I-13 also supported the notion that public opinion can trigger change. But they linked public opinion with the media. I-22 provided two examples of the power of the 'the press' over the public who can trigger policy change. The first instance was *"the alar issue with the apples in the 80s brought to the attention of the public by the press".* The second example was *"Upton Sinclair's exposure of the Chicago meat industry in the 30s. These were examples of good press and changes needed to be made – the meat issue resulted in the birth of the FDA".* He also pointed out however that *"most journalists have no science background nor do they understand statistics. Therefore a lot of media reports are based on faulty science and the journalists don't know what they're talking about – but they're riling the public".* I-13 added that *"public opinion is driven by the media. But government only responds to big issues and what is perceived to bring value to the party in power … Public policy in Canada is just too reactive and not proactive".*

I-11 also agreed that the *"the voters can demand change … but how much they are really listened to – ask the politicians".* I-25 joined the chorus and argued that any triggers *"are all political".* He then asked: *"What are the politicians saying"?* This point will be addressed below outlining the response of a politician.

Two interviewees (I-10, I-13) identified another influencing actor group on politicians: big business. I-10 demonstrated his point by noting that *"a lot of government money has supported biotech even though the public doesn't want it. Politics is getting into bed with big companies who play just too much of a role in policy development".* I-13 argued similarly. *"SMEs are not in a position of influencing public policy. It's the large companies that influence public policy because they can lobby ministers".*

Scientific evidence

Three interviewees (I-10, I-21, I-24) argued that scientific evidence triggers policy development. I-24 followed up his point regarding the discovery of the effects of trans fat on the body. Those scientific findings triggered new policies.

I-21 followed the pathway of scientific evidence noting that scientific findings are leading to new technologies *"particularly in information technology which will be used to include previously excluded stakeholders"* and trigger new policies.

Crisis

Similar to I-7, I-2 argued that *"crisis always leads to new policies. Just think of all the new policies that were triggered by '9/11'. But that doesn't mean that the policies are effective".*

6.2.3 Policy environment – actor group: research/academia

Six interviewees from the research/academic actor group responded to the question regarding policies that could enable innovation. All but one interviewee argued for certain actions to be taken whether they were in the policy realm or other areas. A-3 argued against government policy with respect to business. While government focus should be on *"the provision of security of people … government needs to stay out of the way of business and stay out of business".* This line of thought supports that of I-22, the American interviewee representing an MNE. It was interesting therefore that A-3 added *"I should have been an American".* A-4 however argued for government participation because *"Canada is just a little house on a big piece of property. So Canada needs policies to assist".*

Interviewees identified three areas in which government policies should be directed: capacity building (A1, A-2, A4, A-5, A-6); and programs (A-2, A3).

Capacity building

"We need to network together … If everyone is doing their part then we can be more innovative and use food as a tool for health". These words addressed A-1's major argument for the need for collaboration. While he argued for collaboration among the various actor groups, industry including MNEs, government and researchers *"and NGOs such as CAPI"* [Canadian Agri-Food Policy Institute], A-2 expressed concern regarding the current status and what it will take to collaborate. He argued that *"there is a huge disconnect between government and industry … Government institutions alone in Canada – even within departments – act in silos and do not coordinate".* He noted this lack of collaboration is particularly true with respect to research.

A-2 went so far as stating that international consortia should be established to address specific areas of health prevention. He argued that by establishing such collaborations or various consortia, that *"Canada could take the lead in certain areas. We can't be all things to all people – we shouldn't be duplicating work being done in other regions".* A-4 also

raised this point and noted that international networks and collaborations across *"the supply chain and research networks are needed. We don't have a strong enough Canadian market and therefore not a large enough research community … We need policies that will enable networks and collaborations".*

A-6 took an approach that was unique among the interviewees to collaboration gaps. He put it in terms of a *"jurisdictional disconnect between the regulatory environment controlled by Health Canada and the implementation of health care through the provinces. If Health Canada had to cough up all the money for health care, then the story would be different. The biggest single impediment to innovation in this sector is that Health Canada is not accountable to health providers – the provinces … Health Canada has an extreme risk aversion and there are no consequences for their actions. Health Canada doesn't care about innovation".*

Human resource capacity was also addressed by A-1, A-2 and A-5. A-2 argued for the need to build entrepreneurship capacity by focusing on this area with the school system. He views *"entrepreneurship as a very important part to innovation".*

Capabilities in commercialization are lacking in Canada in the view of A-5. She stated that her experience indicated a gap in knowledge in this area on the part of all actor groups. A-1 also expressed the view that *"no one in Canada knows how to do it"* [commercialization]. He continued however that knowledge in the area of commercialization is not the only gap. An understanding of technical and scientific issues is severely lacking in government *"and we need to have those knowledgeable people in government".*

As a concluding point for capacity building, A-6 identified the need for policies that will support *"more infrastructure. We need more infrastructure – more pilot plants and research stations".*

Programs

A-2 identified the need for increased support for research programs. He argued that *"we continue to under invest in research. Policies need to increase the level of investment in agricultural research. Australia is much further ahead than Canada … In Canada, agricultural research is one eighth of a percent of all investment in research unlike other OECD countries that invest two to three percent of GDP".*

While A-3 argued for as little involvement of government as possible in business, he did however point to the need for more tax incentives.

Triggers for change

Two research/academic interviewees (A-1, A-6) stated they were unsure of possible triggers for change in policy. A-1 added that he has *"been working on this all of my professional career and it's still puzzling how things get done in government".*

The remaining four interviewees identified four possible triggers in total of policy change: new vision (A-3, A-4, A-6); institutional change (A-2, A-4); crisis (A-3); and politicians (A-4).

New vision

A-3, A-4 and A-6 called for a new vision or mentality within government that would lead change. A-4 argued that *"for policy to change, the public and industry need confidence that something will happen. Essentially they need reassurances that changes will happen and then action must be taken. Therefore, there needs to be someone that leads policy change who is believable. And frankly, I have no idea who that could be. The government has just lost all credibility".* When asked for clarification on his definition of 'government', he explained that in this case he was making reference to both the *"politicians and the bureaucrats".*

A-4 continued to argue that industry and Canadians alike cannot escape blame for the current loss of credibility of the government. He argued that they must *"shift their expectations of government … In Canada, we always have our hands out and expect government to solve all our ills. We need to work together to clearly enunciate the direction that collectively we're going to work towards".*

With respect to a new vision, futurists and foresight expertise are often referenced. A-3 believes that foresight can trigger new policies *"but the concept is still too new"* and therefore lacks sound measures that would allow government to *"buy into the process to any great extent".*

While calling for the need for a new vision that could trigger change, A-6 noted that *"it's a bizarre situation. Almost all futurists in this sector have a severe health problem – and they're the ones that are influencing our health and wellness policies".* He continued that if innovation in this sector is to thrive, then Health Canada must set a new vision. He argued that *"Health Canada has a naïve utopian vision. 'If we only ate healthy' – well that ain't*

going to happen. Healthy eating is an anti innovation strategy. It's anti technology. And it's completely impractical".

Institutional change

Two interviewees (A-2, A-4) described institutional change as triggers for new policy. A-2 paused for a significant period of time prior to responding to this question. Note that one of his areas of expertise is science policy. He finally expressed his thoughts by stating *"you can't study innovation on an ad hoc basis which is being done now. We need institutional change. The policy-making process has become too politicized in Canada. There is no consistency between governments and elections. It needs more independence … Policy is at the whim of the government"* [ruling party]. He continued to argue that there appears to be *"no policy dialogue"* either within the public service or outside of government. Right now, *"the Conservatives are in control".*

Similar to the concern expressed by I-1, A-2 and A-4 lamented the institutional change resulting in the dismantling of the Office of the National Science Advisor which they perceived as an impetus to trigger policy change that would spur science.

Crisis

Crisis triggers new policy. A-3 identified events such as *"9/11 spawning all types of innovation and new policies".*

Politicians

A-4 identified triggers as being *"political. And the political environment is not good right now. We are jaundiced by politicians".*

6.2.4 Policy environment – actor group: government

Five public service representatives of government (G-1, G-2, G-3, G-4, G-6) were asked to identify policies that would enable innovation. Five interviewees representing the public service responded. All five interviewees prefaced their responses with introductory remarks that are worth noting.

G-3 questioned whether Canada has made any progress in innovation activity. He noted that innovation requires time to measure results. He then argued that *"the question you really need to ask for policy is – if government did nothing, would we be better off"?* He did not respond to his own question but stated that he needed to get to another meeting and left the interview.

The term policy was interpreted by some government interviewees as money or investment. G-6 put forward *"the question really is whether it's possible to enable innovation. If I had more money, what does it mean? More money doesn't lead to more innovation necessarily. Innovation is an internal desire and government can't create that. So any policy that focuses on internal desire would be questionable. Yes we need to encourage innovation and government has a place in it".* Her explanation of the government role is outlined below.

G-1 also followed the money theme. He argued that the question must be asked: *"what is a justifiable use of public money that goes to industry. If the benefits flow to the public, then it can be justified … fundamentally, policy needs to focus on public benefit and not company benefit".* Interestingly, he argued against the position of I-1 who focused on innovation as an outcome which focuses on increasing a country's GDP. He stated that *"money directed at companies with the goal of simply increasing the GDP, then the investment of public funds cannot be justified".* G-4 however noted that is the focus of the current Conservative government, increasing GDP.

G-2 also focused on government policies and the public. He argued that *"the government must balance risk. There is a responsibility of protecting the public. The goal posts for innovation are much narrower when it comes to public safety. Public safety trumps innovation".*

Similar to other interviewees, G-4 argued that politics come into the fray when discussing policy. When targeting policies focused on enabling innovation, he argued that *"we need to ask where do we fit on the global front? We can't do it all. The government can't support everything. The government sets the nation's priorities which has political consequences. And when politics are involved – all bets are off".*

With the above questions posed and points made, the interviewees identified three general 'policy' areas that could enable innovation in the sector: capacity building; programs; and regulations.

Capacity building

The interviewees described four different components of capacity building that should be the focus of policy that will enable innovation. They are: collaboration; 'derisking' technology development; human resources; and infrastructure.

Two interviewees (G-1, G-4) spoke at length of the need for policies that facilitate collaboration or networks within or among actor groups. The two interviewees have senior positions within their departments responsible for innovation and/or science and technology.

G-1 recognizes the need for collaboration between *"government and industry"* to ensure that scientific discoveries are commercialized. He argued that *"in Canada, we do a great job at discovery. Commercialization is hindered however because there is a gap that isn't being filled – the middle part. There needs to be more effort through collaboration of all stakeholders in proof of concept and then a lesser emphasis on scale-up as the industry starts to take over responsibility for activities closer to the market".* He continued that there are *"gaps that currently exist in the networking and collaboration among the players in innovation. It should result in more transformational innovation as it looks forward … After all, it's all about relationships".*

G-1 continued prefacing his remarks that policy *"is about setting strategic vision – about roles and responsibilities of government*". He argued that collaboration is *"where government can play a role – we can step in and be part of that collaboration almost being the marriage broker. That's what's needed because of the complex nature of innovation".*

G-4 was the most articulate of all interviewees regarding the need for collaboration and networking. He began his argument by referencing his theory of innovation regarding the convergence of various science domains as outlined in Figure 26 on page 193. He observed that *"universities have artificially kept these domains separate and they are naturally starting to overlap*". He provided the example of the emergence of a new domain as a result of the convergence of information communication technology and nanotechnology. The benefit of the convergence he believes is the difficulty in replicating the integration. *"It gives a market advantage. To realize the convergence and then harness it – the key glue is the social end of it … The number one priority must be integrating the innovation system – private, university and public sectors. But how does the nation of Canada bring those together … and it's only through a social approach that we can do that. There are those in government that don't agree with that approach. They believe technology will happen on its own … And in a government science and technology policy setting, and the current regime, the lion's share is on economic, not social considerations. And you will achieve the economic outcomes if you go through the social route to get there. But the current regime doesn't understand that".* He stated that the current focus of science and technology is focused on investment in universities. He believes however that *"we need to reinvestigate the balance of investment in public, private and university"* actor groups.

G-4 continued that Canada's investment in higher education is *"skewed and so far out compared to other nations in this area. We have put all of our eggs in here".* He argued that government expenditures in research and development must be increased. *"We're sixteenth globally and we should be much higher".* He continued that the Conservative government's goal is to focus on increasing business expenditures on research and development but *"the government is just whistling Dixie by focusing on this. It won't happen. Government should play a role in that by integrating the innovation system because the private sector is just not going to ramp up its investment in research and development. We need to derisk technology platforms and then small companies can take on more. Government can develop the platforms to be functional and then hold auctions. It's the way to ensure a level playing field".* In that context, he argued for the need for investment in infrastructure to facilitate the development of the technology platforms.

G-4 also bemoaned the issue of government departments not communicating let alone collaborating. *"There are just too many silos in government. By not talking to each other, it's a missed opportunity for Canada".*

Building capacity in human resources was addressed by G-6 and G-4. G-6 identified the *"need to foster entrepreneurism".* She referred back to her violin metaphor as noted on page 241, and stated that mentors can nurture a violinist to his or her potential just as mentors can and should help entrepreneurs. This point was also made by I-17 previously. G-6 argued for the need for mentors to help in the development of entrepreneurs who she views as the foundation of innovation.

G-6 provided another example of the need for mentoring. She referred to Malcolm Gladwell's book, *Outliers The Story of Success*. She recalled Gladwell's story of *"the smartest man in America. Everything went against him. No one helped him. At every turn, there was something that went against him. Imagine what he could have achieved – imagine what benefits there could have been to society, if someone had taken him under their wing and helped him along the way. We need mentors".*

While G-4 did not use the term mentor, he referred to experience. He noted that industry often calls for the need for highly qualified people (HQP). And indeed, FFNHP interviewees I-1, I-2, I-5, I-14 and I-20 confirmed that assertion as noted in previous sections. G-4 argued however that *"there is just no demand in SMEs for HQP because they don't have the money or the capacity to train them in what they do … They need immediate help. They need*

people who can hit the ground running. We need to find a way to convert HQP into HSP – highly seasoned personnel".

Programs

G-1, G-2 and G-3 discussed programs. The interviewees identified tax incentives in the form of *"a business friendly tax system"* (G-3) or the SR&ED tax incentive that all three identified.

G-1 however did not call SR&ED a tax incentive or program but rather a policy tool. He argued that the enablers are *"policy tools such as the regulatory regime and SR&ED tax incentives. After that, what else matters? Programs are simply tools".*

G-2 however noted that research funding programs are of benefit to innovation in the country but acknowledged that these programs must take into consideration the longer time frame required by this sector to achieve results. *"Unfortunately, programs have limited time frames and are often not conducive to sectors such as this".*

Regulations

G-1 and G-2 discussed the regulations. G-1 called for a better understanding by the regulators of the food system. He argued that the *"regulators … must be able to evaluate and approve products on a timely basis. Innovation requires much quicker action on the part of regulators".*

G-2 simply stated that a simpler regulatory system would enable innovation.

Triggers for change

Three interviewees (G-1, G-2, G-4) representing the public service responded to the question regarding what might trigger the 'policies' they suggested. G-3 had ended the interview with the previous question and G-6 stated that she did not know what would trigger new policies *"in the current environment".* G-2 and G-4 as well as several interviewees identified previously suggested that this particular question be posed to a politician. G-2 stated that *"the government of the day has its own agenda and it would be useful to ask a politician what the triggers are".* As a result of the comments, a politician, a Member of Parliament (G-5) and member of the governing party was interviewed for his views. They are incorporated into the following section as a part of the government actor group.

G-5 prefaced his remarks by arguing that *"there is no magic trigger here … The real question is how do you make decisions? When do you consult your constituents? The*

topics can be extremely complex". He gave the example of multi lateral trade policy. *"that's just too complex to depend on your constituency to make an informed decision. But then there is capital punishment. That's pretty cut and dried. Conceptually, the constituents can understand it and therefore can make a decision about whether to support it or not. It all depends on the level of complexity of the topic".*

The government actor group identified three triggers of policy development. In descending order of support, they were: the actors affiliated with government (G-1, G-2, G4, G-5); crisis (G-2, G-5); and globalization (G-2).

Actors affiliated with government

Two government interviewees identified the public as a trigger of policy. G-1 qualified it further by noting *"it's the public getting nervous about various issues".* G-5, the politician, also spoke about the role of the public in triggering policy. He discussed it in the context of *"the public outcry and the political market".* He identified a specific high profile abuse case of animals that was in the media several times in the previous months prior to the interview. *"The public was so outraged that new policies were implemented".*

G-5 also noted that the public outcry is *"usually a result of media coverage".* In that sense then, the media also triggers new policy by strengthening the public outcry for change. He also acknowledged that *"the media often raises issues the government were not aware of".*

G-5 then continued with his discussion concerning the public and the *"political market in the macro sense. If the public outcry was limited to only a very small percentage of the population, then it wouldn't be worth the while of the politicians to pay much attention … the cost of policy can be focused and if the public benefit is mainstream and not niche then that will trigger policy … the goal is gaining political capital with your constituency".* He provided the example of determining whether to continue the level of funding for the Canadian Broadcasting Corporation (CBC) and the decision to reduce the Goods and Services Tax. *"Every Canadian benefits by a reduction in the GST by two cents. But funding the CBC would require keeping the GST at higher levels. The reality is that the people who listen to the CBC are never going to vote Conservative anyway. So go for the reduction in GST".* The implication is that the cost / benefit analysis of policy favours the cost of political support of the electorate over the public benefit derived. As a result, the politicians or *"political capital"* described by G-5 triggers policy-making.

As identified previously G-2 and G-4 also identified the politicians as triggers. G-4 added that the political party in power at the time sets the nation's agenda which in turn triggers new policy.

G-5 the politician also discussed policy initiated by Ministers in the Cabinet. He explained that *"policy can be founded in ideas that Ministers bring to the Cabinet … For instance, I get ideas from my staff, books I read, places I visit, meetings I attend, other jurisdictions and government departments. The bureaucracy does the analysis within the department to see if the idea will fly. In the end … any ideas brought forward need a champion from somewhere".*

G-5 also identified the *"bureaucracy"* as triggers of policy. *"The bureaucracy will bring forward policies that have been instituted in the past and need renewal or changes".*

Crisis

Two interviewees (G-2, G-5) identified 'crisis' as a trigger for policy. G-2 stated *"when someone dies, then things in government move fast".* He provided the example of Severe Acute Respiratory Syndrome (SARS) that affected the world in 2002. The Toronto, Ontario area was hit particularly hard *"with dozens of deaths. All kinds of new policies resulted from that".*

While categorized under 'crisis', G-5 used the term 'events' as policy triggers. He identified the effects of *"9/11 that spawned policy right from foreign policy, trade policy, security, transportation policy".*

Globalization

Globalization was also identified as a policy trigger. G-2 argued that "*globalization is a big trigger right now … as everyone is concerned about products originating in China. It's all about product safety. Canadian citizens trust their government to protect them and it's our job to ensure that we do it".* As a result he explained that policies relating to traceability have come to the forefront and are being implemented in Canada.

6.2.5 Policy environment – actor group: non government organization

The two NGO interviewees identified capacity building and programs as policies that would enable innovation.

Capacity building

Each of the two NGO interviewees captured different aspects of capacity building in their suggestions regarding policy. NGO-1 argued for the need for infrastructure while NGO-2 argued for collaboration.

With respect to infrastructure, NGO-1 observed that the impact of such a large country as Canada is that easy access to appropriate infrastructure is better in some regions of the country than others. He argued that *"there needs to be well equipped centres throughout".* He specifically made reference to business and scientific incubators to assist entrepreneurs. *"There are some incubators … but on the whole, policies are not helpful to entrepreneurs. The incubators are too costly … they have to be able to keep the costs down".*

NGO-2 discussed the need for collaboration among government departments to ensure a more holistic approach to policy-making *"where regulatory, tax, investment, social policy, innovation, agriculture and healthcare are dealt with in an integrative manner".* He observed that some government departments are now beginning to work more closely with each while in other instances *"the discussions are only beginning".*

Programs

NGO-1 identified the need for more program funding from government for assistance in research and development. He noted that in his experience, the National Institutes for Health and Small Business Programs in the United States *"offer far more programs to small businesses in all areas of commercialization".* He argued that *"if this sector is to really progress, there needs to be funding available to do human clinical trials. Companies can receive $20M in the U.S. to do this. Why can't we get that here? We need money for substantiation."*

Triggers for change

The NGO actor group identified the actors in the policy arena and emerging science as triggers of new policy in Canada. NGO-1 however argued that *"the triggers are difficult in Canada because we have such regional issues. It's so much easier to move quickly when making local policies than if dealing at the federal level".*

Actors in the policy arena

NGO-2 identified two actors in the policy arena – the electorate and the media. He argued that *"the trigger is the electorate – what's at the top of people's minds. But then it's really the media that tells people what areas they should be interested in".*

NGO-1 joined the chorus of interviewees who stated that *"in the end, you need to ask a politician this question".* Similar to the point made by I-5, this interviewee also argued that the politicians are being lobbied by the farm groups in the country. He argued that support for innovation *"will be an uphill battle right now as the focus is on the farmer. Farm organizations are pushing hard for support at the production level and that's where the efforts are going".*

Emerging science

NGO-2 identified emerging science as being a trigger for policy. He noted however that the emerging science presents issues in policy-making because *"when do we ever agree on research".*

6.3 Interviewees' final thoughts

At the conclusion of the interview, each interviewee was asked if they had final thoughts. Six interviewees (I-17, I-19, I-20, I-23, I-25 and G-6) expressed appreciation for being given the opportunity to discuss the topic. The first four represented FFNHP companies while I-25 represented a small food technology-based company. I-23 appeared to be most appreciative and stated *"this was great. It was wonderful to get out of my work mode and have this conversation. It brought the passion back".* I-19 added that *"I really enjoyed this. There's never enough time to talk about important concepts".* And I-20 thanked the researcher for *"allowing me to explore the entire area again of innovation and how we approach it in our company".*

I-9 and I-13 posed questions in summing up their thoughts which were surprisingly similar. I-9 (FFNHP sector interviewee) stated that in exploring the concept of innovation, *"the question of 'do we need innovation' must be asked".* He answered his own question. He argued that *"it's a necessary component for a country such as Canada to compete".* Since Canada cannot compete on price, then supporting innovation in his opinion is critical.

Similarly, I-13 (food sector interviewee) asked *"so what about the 'so-what' question? Is it important that we in Canada focus on innovation? And the answer is yes".* He stated that the Canadian government needs to better understand how the Canadian tax payer dollar can better *"capture value for Canadian SMEs because that's the core of Canadian business. And we all need to better understand how to build on work being done in other regions".*

6.4 Conclusion

This chapter addressed the research questions four and five: How has Canadian innovation policy framed innovation in the food system in general and has the framework affected growth or restriction of small and medium sized enterprises in one or both of the segments? What kind of policy framework would assist the growth of innovation in small and medium sized enterprises in Canada in the emerging FFNHP sector?

While this chapter concludes that innovation is important to all actor groups, there is a general lack of knowledge regarding Canada's public policy directed at innovation including within government. [Note however that interviews were conducted less than a year after Canada's Innovation Policy was transformed into a Science and Technology Policy. Individual government departments however continue to have policies and programs that target innovation.]

The findings demonstrate that no policy dialogue is occurring within or among the actors of innovation including within the actor group of policy-makers. As well there is little understanding of policy-making in Canada under the present political regime and therefore it lacks transparency. The primary concern is that the current policy atmosphere is one of fear among Canadian public servants. The political nature of policy-making currently is having a negative impact on innovation and thus creating tension among and within the actors of innovation.

The conclusion is that the policy environment in Canada lacks vision, dialogue, goals and action. As well, it appears to incorporate little evidence and is politically driven. Any policy-making that is occurring is done in silos rather than a holistic, solutions-led approach which would be required given the complex nature of innovation.

The field work also indicates that the bigger the company, the less likely they are wanting government involvement in innovation. SMEs however cannot afford to undertake innovation activities alone and look to government for assistance. Programs flowing from

policy however have become onerous in their application and reporting processes limiting SMEs' ability to participate due to limited resources.

With respect to a framework that would assist companies in their innovation efforts, the findings indicate there is a clear role for policy-makers. The actors all agree with the need for a regulatory process for food and FFNHPs. Most interviewees however believe that the regulatory environment in Canada for functional foods and natural health products weighs too heavily on the side of risk with little regard for benefit that these products could offer. Almost all interviewees support an evidence based approach to the regulatory environment but more proportionate that the pharmaceutical model currently favoured by Health Canada.

The current taxation policy is one area that has proven to be a benefit for SMEs in innovation activity through the SR&ED credits. This area should be expanded and refined to speed the process of flowing money back to the companies in a timelier basis.

The findings also indicate that government can play a role in capacity building which is seen as a foundation of innovation activity resulting in growth of the sector. Capacity building is viewed in the areas of collaboration, human resources and infrastructure. The challenge of capacity building in Canada to facilitate innovation is the magnitude of the country and the need to build capacity in each of the regions. Policy-making would need to take into consideration the regional needs and build capacity accordingly.

The research also demonstrates that capacity building must not be seen by policy-makers as focusing on external actors, but also internally as well. Analytical capacity building is required within government in the area of understanding science and technology to better evaluate evidence for policy considerations. It is unclear however as to what benefit it would provide at this time given the strong influence of the political arm of government in policy-making currently.

The major conclusion of this chapter is that current government policies and programs in Canada are a drag on innovation in the FFNHP and food sectors.

CHAPTER SEVEN – Analytic lessons and implications for theory

7.0 INTRODUCTION

The research explored a public policy environment that enables innovation. This chapter analyzes the research findings and identifies the wider policy implications drawn from them.

The research process began by assessing the state of the agri-food system in Canada and the policy environment with respect to innovation in which it operates. To provide focus, innovation in Canada's functional food and natural health product segment was specifically examined as innovation is deemed to be important to it. This segment was compared to innovation in the traditional food manufacturing segment.

Utilizing qualitative research methods, forty active elite interviews were conducted across four actor groups: industry, university, government and the public (represented by nongovernment organizations). Five research questions were generated for the investigation: 1) How is innovation defined and approached in Canada's functional food and natural health products segment and its food manufacturing segment? 2) What is driving innovation in these segments? 3) How is innovation measured? 4) How has Canadian innovation policy framed innovation in the food system in general and has the framework affected growth or restriction of small and medium sized enterprises in one or both of the segments? 5) What kind of policy framework would assist the growth of innovation in small and medium sized enterprises in Canada in the emerging functional food and natural health product segment? The interviewees demonstrated richness of thought and understanding regarding the research questions.

This chapter presents four key analytic lessons derived from the findings. The first analytic lesson argues that new knowledge is added by expanding the multi-dimensional definition of innovation to include human elements. The argument is that innovation is the convergence of: 1) an evolutionary complex system; 2) the human elements of insight, imagination; and 3) adoption of invention.

The second key analytic lesson is that the concept of innovation is not unique to an industry. The nature of the industry however limits the extent to which society accepts the applications of innovation. With respect to the food system, these applications are limited by: 1) emotional and theological attachment to food; 2) physiological requirement for nutrition; 3)

relatively low margins; 4) potential for harm to the person; and 5) linkage of food to health outcomes.

The third key analytic lesson is that innovation is difficult to measure. This point is consistent with the literature. The rationale for the finding revolves around four factors and appears to be a combination of several factors: 1) economic outcome pressures regarding innovation; 2) the complex nature of innovation; 3) the complex nature of preventative health; and 4) serendipity associated with innovation.

The fourth key analytic lesson is that federal policy as it affects innovation in the Canadian FFNHP sector is not context-based, evidence-based. The conclusion is that policy-making in Canada may be influenced solely by one contextual factor: ideology of the political party currently in power. In addition to lack of attention to evidence linking diet to health, this fourth key analytic lesson is also based on three key findings: 1) the lack of knowledge regarding innovation policy in Canada; 2) the disconnect between and among institutions of innovation; and 3) the lack of policy dialogue occurring in Canada.

These four analytic lessons resulted in identification of the need for a solutions-led approach to policy-making in Canada. This chapter supports the need for a paradigm shift in policy-making. The solutions-led approach aims for outcomes that result in a healthier Canada combining human, environmental and societal health.

7.1 Analytic lesson 1: Lack of common understanding of the concept of innovation in Canada's value-added agri-food system

Critical to policy development with respect to innovation is an understanding of the topic under discussion. The field work however demonstrated a lack of common understanding of the concept of innovation. This finding is consistent with that found in the literature where Arthur and Conway and Steward conducted a secondary search which resulted in the same conclusion (Arthur 2009; Conway & Steward 2009).

In addition, a wider review of the literature identified four major concepts of innovation (see Section 1.2.1). The first definition focused on innovation as an output (Bercovitz & Feldman 2005; Ezell & Atkinson 2010; Hamel 2003; Terwiesch & Ulrich 2009). The second definition focused on innovation as a process (Etzkowitz 2005; Ezell & Atkinson 2010; Freeman & Louca 2001; Munn-Venn 2006; Nelson & Winter 1997; Rheaume et al. 2006; Steward 2010a; Sylver 2006; Peters 2002). Innovation was also described as a system or complex

system or systems (Baber 2005; Barber 2003; Bercovitz & Feldman 2005; Conway & Steward 2009; Jacob 2006; Katz 2006). And fourthly, descriptors were utilized in the literature to describe innovation (Baber 2005; Barber 2003; Bercovitz & Feldman 2005; Coates 2005; Davila et al. 2006; Dobni 2006; Dobni 2008; Etzkowitz 2005; Hamel 2003; Munn-Venn 2006; Terwiesch & Ulrich 2009).

The definitions as described were not found to be mutually exclusive in the majority of cases. In other words, the definitions of innovation provided by most authors could be classified under more than one concept.

Consistent with the literature and as described in Chapter Four, the interviewees across all actor groups struggled in describing their understanding of innovation. This point was not unexpected. In the end however, the interviewees classified innovation under five major categories and seven adjectives or descriptors. The categories in order of support were: outcome, mindset, discovery, process and system. With respect to adjectives, in order of support they were: new (or novel), timely, transformational, incremental, market-driven, serendipitous and patentable.

Note however that in all but three instances, the concept of innovation was described utilizing two or more categories which was consistent with the literature. As well, in all instances but one, it was described with one or more adjectives. The multiple definitions of innovation in both the literature and the findings of the research indicate that innovation is multi-dimensional. It supports the argument put forward by A-3, an academic whose expertise lies in the area of innovation. He stated that innovation must be regarded as multi-dimensional rather than a one dimensional approach.

The multi-dimensional model is not unlike the one utilized by Arthur in defining technology. Arthur argues that the definition of technology is a combination of three definitions, each one critical to understanding the meaning of technology. *"Technology is a means to fulfill a human purpose … technology as an assemblage of practices and components … technology as the entire collection of devices and engineering practices available to culture"* (Arthur 2009) p.28. In other words, Arthur views technology as a combination of an outcome, a process and an output, each dependent on the other components to gain a true understanding of the concept of technology. The use of this example is particularly interesting as eighty percent of the interviewees included the outcome of a new technology within their concept of innovation.

The category of outcome as defined by the delivery of value was the most common category raised by the interviewees. Support for this argument is spread across actor groups. Value was defined in both economic and intrinsic terms. With respect to economic, it was defined as bringing economic return to investors or to the country by adding to the gross domestic product. The literature supported this view and pointed out that the expected outcome of innovation is mostly focused on the economic rather than the social benefit (Bercovitz & Feldman 2005; Dobni 2008; Etzkowitz 2005; Ezell & Atkinson 2010; Munn-Venn 2006; Nelson & Winter 1977; Rheaume et al. 2006; Terwiesch & Ulrich 2009).

With respect to intrinsic terms, value is viewed in terms of benefit to the end buyer. For example, there may be a new food or natural health product that staves off the onset of diabetes, assists in reducing cholesterol levels in the blood or a new product that saves time. For the time strapped buyer, any new initiative, service, product or technology that results in saving time may be considered by them to be innovation.

Intrinsic value was also identified by the perceived benefit to users which also changed their behaviour or the behaviour of a sector. The example of technical innovation that resulted in the automobile was described in terms of the opportunities opened to its users for transportation which impacted everything from their Sunday afternoon leisure time to business opportunities that allowed them to deliver goods and services to a wider network. Another example was the impact of the iPod which facilitated the downloading of music from the internet. This innovation was transformational changing the way consumers behaved in accessing music, providing benefit to the user by allowing them to purchase single songs in multiple environments. It also changed the way the music industry delivered its product to the buyer (i.e. electronically rather than through the retail channel).

Value was also identified in terms of public good benefit such as a healthier environment or cleaner water supply, value that is derived by the public as a whole. This point however was usually made as an afterthought or a secondary benefit. The primary emphasis was on economic value. Given that sixty-five percent of the interviewees were heads or leaders of for profit organizations, it is not surprising that innovation was defined in terms of economic outcomes. Coates however argues that we must shift the discussion regarding innovation to also focus on the social context and public good (Coates 2005).

It is important however not to completely dismiss one type of benefit (economic) over another (public good). Innovation requires the interplay of all actor groups. If industry participates, economic benefit will be required. If government participates, the public interest

or public good must be or should be represented. The 'discussion' as Coates terms it therefore must not be just a shift to the public good or social context but rather how both public and private interests can be satisfied.

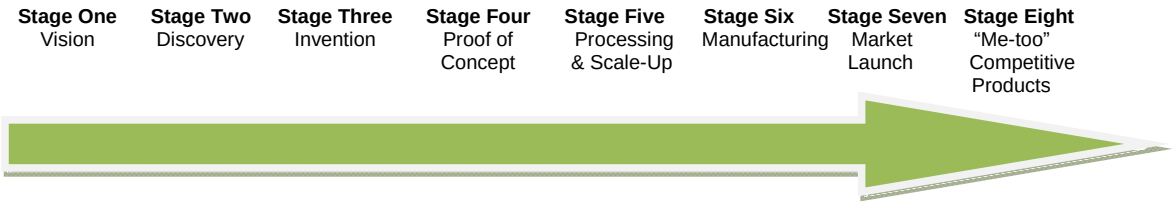
The vital element of benefit is recognized in the literature as a key component of innovation. Davila et al. argue that innovation meets organizational objectives, thereby bringing benefit to an organization. In broader sense, the literature identified innovation as the translation of knowledge into simply something of value (Barber 2003; Bercovitz & Feldman 2005; Dobni 2006; Dobni 2008; Etzkowitz 2005; Munn-Venn 2006).

As well, Conway and Steward imply value by noting that one half of the innovation equation is "*bringing into common usage"* (p.10) which in itself implies value or benefit (Conway & Steward 2009). Without this element in their definition, the invention (the other half of their innovation equation) would not be adopted by the user in the economic or social sense.

The second component defining innovation as an outcome was identified in the field work in tangible terms as either a product or technology. There is support in the literature for this line of thinking. The literature identifies tangible outcomes, products or technologies (albeit new or novel) as an element of innovation (Hamel 2003; Conway & Steward 2009), but there appears to be no support to limit a tangible outcome as the sole definition of innovation.

With respect to regarding innovation as a process, the vast majority of interviewees discussed innovation in terms of the commercialization process. Where these interviewees differed was the position of the beginning and ending points of the process. Figure 34 below illustrates the elements of innovation as described by the interviewees.

Figure 34: The traditional commercialization pathway



The predominant theme therefore was a linear approach rather than a complex network. This line of thinking was not unexpected given the market orientation of companies as well

as the current emphasis of Canadian government programs on downstream commercialization efforts.

It is important to note at this juncture that several interviewees discussed discovery. A quarter of the interviewees argue that discovery is a key component of innovation. Rather than the term discovery, authors note the term knowledge (Barber 2003; Bercovitz & Feldman 2005; Dobni 2006; Dobni 2008; Etzkowitz 2005; Munn-Venn 2006). This point assumes that new knowledge and discovery are in fact interchangeable. Conway and Steward however caution against equating discovery to innovation but acknowledge it as one subset linked to the key component of invention (Conway & Steward 2009).

The important issue is that the vast majority of interviewees view innovation as a linear process model where there is a beginning and ending point or an outcome. On the surface, it may demonstrate a lack of understanding of innovation and the complex nature of it. A better explanation however may be that they are only able to perceive innovation from their own vantage point. If that is true, then each interviewee offers not a full picture of innovation, but rather a piece of the puzzle which must be assembled.

The literature review also revealed the primary support for the concept of innovation as a process. Some researchers identify the term process outright (Etzkowitz 2005; Hamel 2003; Munn-Venn 2006). Other researchers use different terms such as effort (Drucker 2002), act of producing (Katz 2002), or technology transfer (Bercovitz and Feldman 2005) for example.

The literature differs from the primary research in describing an end point to innovation. Conway and Steward define innovation in terms of *"invention + bringing into common usage"* (Conway and Steward 2009) p. 10. The definition implies an end point when the invention provides benefit as a matter of course for users. Other references in the literature however note that the process does not have an end point. Etzkowitz for example refers to the process as being *"an endless transition"* (Etzkowitz & Leydesdorff 1997) p.1. Davila et al. do not end the process with an outcome but rather on the process describing innovation as an agent that changes *"the rules of the game in their* [innovating organization's] *favor"* (Davila, Epstein & Shelton 2006) p.28.

With respect to adjectives used to describe innovation, there was agreement in the primary and secondary research for the notions of new, serendipitous, timely, transformational and incremental. There was no support in the literature however for the notion that innovation must be patentable.

Market-driven was another adjective that warrants specific mention. Interviewees view market-driven in terms of providing solutions for users. That answer however assumes that a user has a problem for which they are seeking a solution. Moskowitz and Gofman however argue that consumers may not even know they have a need, problem or expectation and therefore an innovation may not be market-driven. These authors suggest that the iPod is one such product (Moskowitz & Gofman 2007).

The literature supported solutions-led innovation. This concept acknowledges that regimes or systems (e.g. food system, energy system, economic system) may require dramatic transition to address critical problems (Smith et al. 2009; Berkhout et al. 2004). This concept equates to deliberate innovation where a solution is sought to address a need or problem in the market or society. In the context of solutions-led systems innovation, systems are aligned with regimes.

Systems and mindset are two critical elements of the definition of innovation that must be discussed. The concept of innovation as a system has only been evident in the literature in the past decade. Katz even takes the description one step further and denotes innovation as complex systems which are also *"composed of complex subsystems"* (Katz 2006) p.895. Just as the findings of the secondary research argued that supply chains must be considered demand networks, various authors argue that innovation is comprised of systems and cannot occur in isolation of other actors or systems (Bercovitz & Feldman 2005; Conway & Steward 2009; Jacob 2006; Katz 2006).

Only two interviewees described innovation as a system but G-4 a senior policy-maker in innovation, science and technology was more eloquent and insightful. His response was consistent with the literature and discussed the complex systems and domains in science and technology that are converging to reveal *"unforeseen domains"* and opportunities. A key ingredient in the convergence is the role of other actors or the convergence of the actors as demonstrated by the importance of social networks as a key element of the system. This argument is in line with Katz's point regarding *"information flows across its boundaries"* (Katz 2006) p.895 indicating non traditional participants and domains within innovation.

The research supports the emerging concept of innovation as a complex system, one that builds on knowledge and as Jacob argues, evolves over time (Jacob 2006). Ridley also notes the evolutionary nature of innovation (Ridley 2010). He argues that radical change occurs so rarely that realizing value from an organizational or societal perspective is most

likely to result from building on current systems and technologies (Ridley 2010). The inference then is that efforts to find solutions to various challenges would best be placed on incremental rather than radical innovations or dramatic transitions. Nevertheless, the concept that innovation is an evolutionary complex system supports the notion that innovation is multi-dimensional.

The findings of the field work provide the evidence that there must be a new dimension articulated because of the critical nature of that element. The key argument is that innovation is personal and individual. It takes into consideration the concept that innovation is an art. In other words, the definition of innovation is not complete without recognition of a human component. The addition of the human component is supported by the majority of the interviewees whether it was discussed specifically under their definition of innovation or their discussion of the drivers of innovation. The primary research indicates that the innovator's personal attributes are at the very core of innovation. The concept therefore must somehow be captured within the multi-dimensional definition of innovation.

The interviewees discussed this concept in terms of mindset. This term includes the innovator's personal attributes identified by the interviewees as risk taking, vision, foresight, creativity, artistic (the art of innovation), insight, mapping, linking, internal *"wiring"* (as noted by G-6) that allows the innovator to understand the significance of the convergence of disconnected systems or networks that provide either public or private benefit. Whether it is a team, or an individual, the human element was deemed critical to the discussion of innovation.

Dobni hints at this component by identifying the required element of *"revolutionary thinking"* p.332 denoting a human element to the definition in his theory of the innovation blueprint (Dobni 2006). Van de Ven and Poole support Dobni's line of thinking by examining the role of the manager, her strategies and actions, in innovation (Van de Ven & Poole 1989). Conway and Steward also touch on the human element in innovation by arguing the emotional attachment innovators and innovation teams in an organization have with the ideas they wish to take through the innovation *"journey"* (Conway & Steward 2009) p.336.

Peters appears to also support this argument but emphatically argues that innovation is not the idea but rather what knowledge is gained in the application of the idea (Peters 2002). Knowledge implies a human element. Katz as well includes the person in his definition of innovation as a complex system and argues the evidence indicates that innovation is a human activity. He does not however capture the unique human elements within his

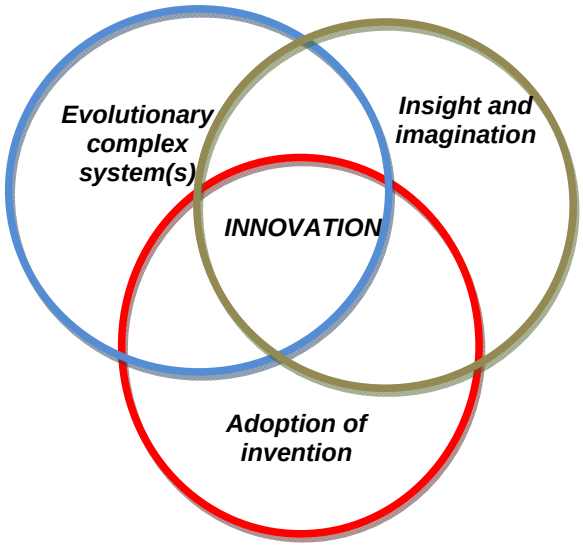
definition but rather links the human component to research and development and the actors that undertake it (Katz 2006).

Johnson also identifies the human component through his discussion of serendipity. He argues that ideas form the basis of innovation and that ideas arise from the gut feeling of the innovator – in other words a personal component. The ideas that have meaning are derived from serendipitous connections of various thoughts and observations (Johnson 2010).

The more recent literature is moving towards a definition of innovation as being a system entailing a much broader definition than simply an output. Whether it is an outcome, process or complex system, this chapter argues that the previous definitions of innovation contained implied elements. By implying these elements only, a critical component of innovation – the innovator's insight plus imagination – has been devalued and therefore an understanding of the concept of innovation has been devalued. The innovator's insight plus imagination in this context is defined as the ability of the innovator to recognize and understand the convergence of social, economic, basic and applied science networks and the potential new applications of the convergence.

The following multi-dimensional, emerging conceptual model of innovation builds on the concepts forwarded specifically by Jacob, Katz, Dobni, Ezell and Atkinson, Conway and Steward, and the evidence resulting from the analysis of the field work. Figure 35 demonstrates that innovation is the convergence of three main elements: 1) an evolutionary complex system; 2) insight and imagination, and 3) adoption of invention. All three elements must be present for innovation to occur.

Figure 35: An emerging conceptual model of innovation



The importance of the term evolutionary (Jacob 2006) indicates that the complex system builds on shared knowledge which implies the combination of: 1) newness and change, and 2) networks. The human elements of insight and imagination in this context are defined collectively as the ability to understand the significance of and see opportunity in the convergence of disconnected systems or networks. Invention and bringing into common usage is taken directly from Conway and Steward's definition of innovation (Conway & Steward 2009) and implies that a novel thing or process has been adopted widely for public or private benefit.

To create effective public policy, the assumption is that investment must be made in three main areas of the complex innovation system. The first area is investment in research (social, economic, basic and applied sciences). The second area is in the early to mid stages of commercialization. The third area of investment is in education which is often measured by the number of engineering and scientific graduates in a country. The follow-on argument is that if investment is made in the various areas, then the significance of the resulting convergence will be evident leaving private industry responsible for later stages of commercialization and the adoption of the innovation.

The field work indicates the ability to recognize the significance of this convergence results in an application that brings value and therefore is adopted for usage is critical and therefore must be an expressed element of innovation as identified in Figure 35 above. The public

policy implication is the need for a better understanding of this element and if, how and when the human element can be enabled. More research of this element is required to understand how and if public policy can impact it. It seems logical that there are policy implications for investment in education.

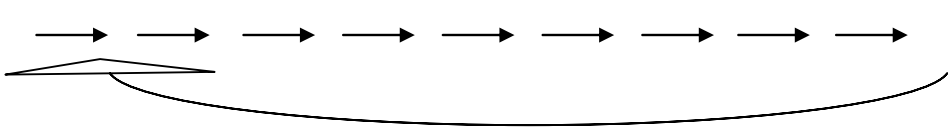
Warnke et al. envisioned various scenarios for future innovation in Europe, one of which was the introduction of innovation skills at a very early age in the educational system. The introduction of innovation skills assumes that Europe deems these skills to be a priority and also assumes that innovation skills can be learned. These authors envision an outcome that produces a workforce that has imagination and possesses the necessary skills to address the key challenges faced by their region and the world. They recognize that not all people have the mindset for innovation and therefore they question the educational outcomes of students who are not able to develop these skills (Warnke et al. 2010). The education policy implications of the emerging model of innovation must be examined further.

In summary, innovation is clearly an overused and misunderstood term. Of interest however is the evolving nature of the model. All actors are attempting to gain a better understanding of it. The field work indicates that economic value and competition are currently the primary drivers of innovation. What was most surprising in the field work was that even government interviewees focused primarily on the economic benefits. The public and societal interests appeared to be defined by the economy.

While regional and global issues were acknowledged as being drivers, the sense was that the issues were presented as opportunities for economic returns. For example, the issue of an aging population evolved into discussions of business opportunities rather than societal challenges. In the future, the primary focus for innovation must be on societal challenges. A much better understanding of innovation is critical and how it can be used as a tool in addressing societal challenges.

Table 17 below provides an overview of the emerging model of innovation as well as the current drivers of innovation as identified in the field work. It also identifies future drivers for decision making in the future found in the literature which could lay the foundation for solutions-led innovation.

Table 17: Emerging model of innovation

	CONVERGENCE OF			= INNOVATION
	Evolutionary complex systems	**Insight and imagination**	**Adoption of invention**	
Elements	Newness linked with change	Ability to understand significance of and see opportunity in convergence	Public or private benefit derived	
Feedback Loop				
Current drivers	The innovator/mindset; economics; emerging science; the market/consumers; crisis; aging population; rising health care costs; corporate social responsibility; global and domestic competition; corporate culture; government policy; linkages			
Future drivers of decision making	Global challenges: water scarcity (1)(5)(16); food availability (3)(10)(11)(19); energy (8)(14); climate change variability (4); global economy (12); environmental human migration (15)(17); financial instruments (19); national security (7); globalization (6)(9)(12)(4); supply chains (13); demography (2); public health (2); science and technologies (9)(15)(17)(4); citizen and corporate values (7)			

1) Ashley & Cashman 2006, 2) Awofeso 2004, 3) Blinch & Love 2008, 4) Clarke et al. 2002, 5) Enviornment Canada 2004, 6) Garcia and Grainger 2005, 7) Hodgins 2009 8) IPCC 2007, 9) Isabelle 2005, 10) Lang and Heasman 2004, 11) Lang et al. 2009, 12) Kekic et al. 2006, 13) Markille 2006, 14) National Energy Board 2003, 15) NIC 2004, 16) Nowicki et al. 2006, 17) Scharioth et al. 2004, 18) Tett 2008, 19) World Economic Forum 2008b

Looking forward into the twenty-first century, the world will be faced with societal issues such as the lack of water and arable land, environmental human migration, availability of food, need for alternative energy sources, imbalance of ages in populations (aging in developed countries and very young populations in many emerging nations), rising rates of chronic disease, new domains of science and technology, power imbalances, many of which are not well understood. These are but a few of the issues facing our future. New approaches are required to address these current and future challenges. A systems-led or solutions-led approach to systems innovation will become increasingly important. In other words, deliberate innovation will be required.

This approach however cannot be done at the expense of allowing the mindset and imagination of an innovator to explore where she/he wishes or where their interests lie. Policy-makers and policy influencers will need to find a way to allow for both approaches.

7.2 Analytic lesson 2: New thinking required for innovation in the agri-food sector

The second analytic lesson derived from the findings was that new thinking is required for innovation in the agri-food sector to address global issues. Based on the emerging model of innovation as outlined in the previous section, the findings of the research refute Nelson and Winter's contention that innovation is defined by the industry examined (Nelson & Winter 1977). The lesson gleaned from the analysis of the field work indicates that the nature of the industry limits the extent to which society accepts the applications of innovation, but innovation itself is not defined differently. All three key elements remain. The implication of this finding is that policy-making must address societal concerns as they relate to the targeted industry. The argument is that society views the food system as a unique industry exemplifying the limitations where society is less accepting of the breadth of the application of innovation outcomes than with other industries due to: 1) personal attachment to food; 2) the economics of food; 3) the level of potential harm to the individual; and 4) health insurance. Each factor has public policy implications.

The field work found a personal attachment to food not present in other industries. The personal attachment was expressed in cultural, psychological, emotional and theological terms. These points were most often cited by interviewees as to why innovation in the food system is different than in other sectors. However, the argument is that the three elements of innovation are still present but that the adoption of the invention may not be as wide spread as in other industries due to societal concerns. Interviewees discussed the societal concerns in terms of food being sacred. People attach emotions to food which are linked to friend and family rituals, comfort, reminiscences and communication.

The literature supports this line of thinking. Lang and Heasman discuss this attachment to food with respect to communication and connection with a plethora of actors (Lang & Heasman 2004). Other authors as well cite this aspect and support the primary research from a psychological perspective (Lien 2004b; Nestle 2002; Winson, 1993). There is also an added connection in the sense of a physiological necessity (Goodman & Redclift 1991; Lang & Heasman 2004; Lang et al. 2009; Tansey & Worsley 1995).

No other industry is linked to human beings with such importance due to the need for food to sustain life. Interestingly, none of the interviewees identified this physiological aspect as noted in the literature. Maslow in his motivation theory of hierarchy of needs argued that the physiological needs of hunger and thirst are the very foundation of human needs and that humans will be incapable of progressing to other needs until their physiological need is met (Maslow 1943).

The field work targeted actors in Canada. Canada is a developed nation and enjoys a gross domestic product of just over $40,000 per capita (Brown et al. 2010). While food banks are prevalent across the country and a segment of the population is clearly in need, the interviewees participating in the field work would not have been part of that segment. This includes the government and academic actors interviewed who, it could be argued, should be raising the issues of the disadvantaged. The physiological need for food therefore is not at the forefront of the thinking of the actors of innovation in this case study. The physiological need for food however may have been at the forefront of the minds of the interviewees if the field work had been conducted in less developed nations.

The other personal aspect to the uniqueness of the food system was expressed in theological terms and indeed is an extension of the view of the sacredness of food. It is also an extension of Goodman and Redclift's identification of the use of spirituality and morality used in the debate of the appropriateness of the outcomes of biotechnology (Goodman & Redclift 1991). The field work identified a theological connection with food that results in a very personal connection, a faith connection to the very meaning of life through God. In other words, it is the belief that living organisms created by a higher power must be appreciated and not tampered with, thus putting boundaries around acceptable limits for innovation in this sector, but not redefining it. This theological interchange with nature and living organisms creates a passion in people not present in other sectors.

Goodman and Redclift also discuss this domain and argue the source of the conflict is that innovation in the food system has focused on dominating or subordinating nature to economic interests. As mentioned in Section 1.3.2 this theory of appropriationism is focused on managing the productive capabilities associated with the natural environment. There is a uniqueness in the agriculture and food/nutrition industry from other industries that may limit innovation applications as a result of the conflict and struggle between science and nature. The authors use biotechnology as the prime example noting that it is a transformational technology. In other words, they argue that biotechnology is a game changer for all actors (Goodman & Redclift 1991).

The conflict and struggle between science and nature is an evolving debate. The policy implication of the emotional, physiological and theological connection to food is complex. Policy-makers must not only take into consideration the ethical and societal values, but also ensure a sufficient supply of food is available to feed the population. As global population increases and weather patterns change causing stress on natural resources (e.g. water, energy, arable land), recognized crises or looming crises will drive innovation and result in new technologies that will assist in feeding the stressed global population. The challenge will be in utilizing innovation to solve problems but do not create new ones. An example of just such a case was the use of corn as a feedstock for biofuel. This resulted in a decreased supply of corn for use in the manufacture in food products and increased food prices.

While there is a growing body of evidence demonstrating that we are already in crisis with respect to food availability and food security, the average person in the developed world has not deemed the food system to be in sufficient crisis mode to put pressure on their policy-makers to address the crisis. Jobs, the economy, pensions, criminal justice and national security are taking precedence. The food system is not on the public agenda as yet, at least in Canada.

The economics within the food system was identified as the second element that limits applications of innovation from other industries. Economics was noted in the literature as the significant driver of innovation (Davila et al.; Department of Trade and Industry UK 2003; Dobni 2008; Etzkowitz 2005; Hamel 2003; Rheaume et al. 2006). The findings of the field work support the view of the importance of economic value to shareholders or the country.

The differentiator is the level of economic returns in the food system as opposed to other sectors. The findings of the field work indicate that margins on food products are much lower than products in other industries. The consequence is that the smaller profit margins limit the amount of investment in innovation, particularly transformative innovation, in the food system. This represents a significant challenge for policy-makers. The impact of low margins is that innovation in the food and nutrition sectors focuses primarily on incremental innovation while many other industries focus on transformational innovation.

The smaller margins limit the amount of investment in innovation and particularly transformative innovation in the food system and represent a challenge for policy-makers. The primary research supports this conclusion. For example, the nutrition and food science

department in one of Canada's leading universities is unable to attract the interest of the university to invest in laboratories and research enjoyed by other departments.

The question of profit margins arises in the literature in an additional form. This form is in respect to the shift in power in the food system. The low profit margins realized have resulted in a shift in power in the demand network of the agri-food system from the producers to the retailer. Lang et al. as well as Lang and Heasman and Goodman all point to the shift in power in the agri-food system closer to the end-buyer. This shift results in the increased number of mergers and acquisitions that concentrate power in the hands of a few for increased economic benefit (Goodman 2002; Lang et al. 2009; Lang & Heasman 2004).

The third element of uniqueness in the food system as identified in the field work is the level of potential for harm to the individual which impacts public policy resulting in limits with respect to the scope of applications of innovation. The potential for harm to the person may be greater with relation to food and nutritional products as opposed to products that are not consumed internally. The implication is that public policy with respect to innovation in the food system must then take a cautious approach, a risk reduction approach, to ensure that no harm is done. The literature supports the notion of limitations of innovation in the food system through public policy. It clearly states that policy must focus on public interest (John 1998; Lien 2004; Tansey & Worsley 2004).

Policy-makers equate a safe food supply with public interest. It is appropriate to reiterate the words of a senior policy-maker in Health Canada who argued, *"public safety trumps innovation" (*G-2). It is hard to argue with that point, but the field work indicates that safety should be balanced with the potential health and wellness benefits of new/novel/innovative food products. Currently, public policy in Canada is perceived as a major inhibitor of innovation due to the level of risk reduction taken by government in the development of policy in the food and particularly the FFNHP sector.

The other element of public policy that differentiates the food system from other industries is health insurance. This argument assumes that the food system in general, not just the FFNHP segment, is increasingly intertwined with health. The field work argues that the current health insurance scheme and health care system in Canada support treatment rather than prevention. While the food system is increasingly being pressured to focus on health and wellbeing, the current health insurance scheme 'rewards' treatment based options rather than prevention based options. This point provides another example of how public policy in Canada inhibits innovation in the food system.

Within this theme, there is a need to examine the factors that differentiate the general food system from that of the FFNHP segment. The food system has evolved from an agricultural supply chain that involves the movement of commodities through to the end user, to the development of products and technologies that deliver nutrients and other benefits to the end user (Flueck-Chaloupka et al. 2005; Hobbs 2002).

Lang et al. argue that the benefits are based in evidence that is often disputed and therefore cause difficulty for policy-makers. As well they argue that environmental challenges have strained the global ecosystem (Lang et al. 2009). This point is consistent with the field work that made a case for more emphasis on the social well being of the environment and the sustainability of primary agriculture in the country.

In addition, the application of innovation in the food system can be differentiated from the application of innovation in other economic sectors. At issue then is what comprises the food system. If the food system is restricted to the biological, agricultural and marine resources that are transformed into nutrient laden products and consumed by people, then the evidence of the primary research indicates that the Canadian FFNHP sector has the potential to be more innovative than the food sector.

Interviewees discussed innovation in the FFNHP sector as understanding and standardizing bioavailability and applying that knowledge in food and natural health product applications. In this sense, the FFNHP sector was deemed to focus on transformative innovation changing the way consumers address specific health concerns (i.e. consumer products that address specific health conditions).

The additional uniqueness of the food system that impacts innovation activities in the FFNHP sector was noted as the length of time required to innovate. The field work showed that the time frame can be upwards of ten years or longer. This point is consistent with that of Goodman and Redclift who noted that in 1970s (similar to SMEs in the FFNHP sector of the late 1990s and 2000s), the emerging biotechnology companies lacked the resources to commercialize their research. An additional barrier was the time required for field trials and the need to meet the requirements of the regulatory body (Goodman & Redclift 1991). These points are reflective of the field work conducted for this thesis.

Sankaran concurs and emphasizes the regulatory requirement for evidence-based claims making the FFNHP sector unique. Consistent with the findings of Goodman and Redclift,

the regulatory system results in a longer time frame to commercialize products in this sector. Sankaran also argues that the regulatory environment is stricter in the FFNHP sector than the traditional food sector (Sankaran 2005).

Innovation in the food system with respect to the food processing sector focuses on making small changes to the food resulting in incremental innovation. Analysis of the field work found that transformative innovation occurs in the food system at the production level. Genetic modification of plants was identified as a true innovation, one that changes agronomic methods. As noted previously, Goodman and Redclift argue that biotechnology is a game changer for all actors, not just at primary production (Goodman & Redclift 1991).

If the food system is considered to encompass non biological sources, then the food sector can be deemed to offer a plethora of transformative innovation. The focus of transformative innovation for the food manufacturers and processors is on branding, traceability, equipment, packaging and platform technologies.

Table 18 below provides an overview of the unique factors of food and FFNHPs and their innovation policy implications. The term nutrition is used to encompass both sectors.

Table 18: Innovation policy implications related to uniqueness in the nutrition sector - application of innovation

Uniqueness	Innovation policy implications
Emotional and theological attachment to food	Must be founded on ethical, societal values and social responsibility Must understand the complexity of human behaviour
Physiological requirement for nutrition	Must provide sufficient nutrients (1) to feed the population
Relatively lower margins	Need to invest or attract investment in basic research, as well as research and development
Potential harm to the person	Must focus on risk reduction but balanced with evidence demonstrating health benefit
Linkage of food to health outcomes (funding of treatment based healthcare)	Need to balance investment in treatment with wellness model (food system policy becomes intricately linked with health policy)

1) The issue is no longer ensuring sufficient food for the world's population. Innovation, research and development activities in the food system have focused on the production of higher yields (more food) as well as crops and food for shipping. The cost of these new crops and crop varieties has resulted in a decrease in the nutrient value (Ridley 2010). If nutrients have indeed been bred out of the crops, at the very least, innovation will be required to provide appropriate nutrient value for disadvantaged segments of society.

As noted above, evidence linking food to health outcomes has often been in dispute. The growing body of literature however acknowledges the link. Obesity for example has become

a global epidemic and is credited with costing developed nations between one to three percent of their health care budgets. Canada particularly faces challenges resulting from obesity. A quarter of the population is now classified as overweight or obese and the figure is expected to increase by another five percent by 2020 if not put in check. Obesity is also linked to 25,000 deaths annually in the country (Sassi 2010).

Coyte argues that functional foods and natural health products have the potential to mitigate the effects of various diet related diseases such as cardiovascular disease (CVD). For example, he studied the health economic impact of introducing flax and flax products into the diet of Canadians. He estimates that the annual savings to the economy lie between $1.19 billion to $3.56 billion (Coyte 2005).

The health challenges resulting from nutrition sources are faced by global population in general. Although the Canadian FFNHP sector was examined as a case study with respect to innovation and an enabling environment, it is only part of a much bigger, much more complex issue. It is not reasonable to think that Canada alone can address a global health crisis. Nations must combine their efforts to rethink the concept of innovation and how it can be used to solve challenges and crises facing the world. This call is line with Steward's argument for innovation policy that is challenges led and focuses on a market pull approach (Steward 2010a; Steward 2010b).

In addition, innovation in the food system must not be so managed as to take away from the creative and serendipitous nature of innovation. Global dialogue regarding innovation and the food system is the first step.

Included in the major challenge of addressing the global health care crisis is the link to the public's attachment to their food choices. Health Focus International, a leading global organization studying consumer behaviour with respect to food and food choices, recently conducted a study of consumers in the United States. The results of their study shows the top four health concerns of consumers being mental acuity (sixty-five percent of consumers), cardiovascular disease (sixty-two percent), cancer (sixty-one percent) and bone health (sixty-one percent). Even though consumers are very concerned about these health issues, Health Focus found that seventy-seven percent of consumers are only prepared to make small changes or no changes to their diet and lifestyle (Katz 2010).

A sound understanding of consumer behaviour is required before a solutions-led approach to innovation that addresses the food crisis (under-nutrition in part of the globe and over-

nutrition in other parts, each with public health implications) is effective. The emerging concept of innovation includes the element of the adoption of the invention. If a significant portion of the population is not prepared to make changes to their diets (combined with other influencing factors), then a solutions-led approach will not result in innovation.

Consumers may be reticent to adopt change due to perceptions of various technologies such as the backlash against food products containing genetically modified crops or nanomaterials. Consumers may also have an emotional attachment to some foods that provide no or limited nutrient value thus inhibiting novel nutrient applications. Public policy could assist the adoption of change by supporting more analysis of consumer behaviour.

While the Canadian functional food and natural health products sector was used as a case study, it does not imply that these products could or should be viewed as a magic solution for the global diet related health care crisis. The argument is innovation can be used as a tool in addressing issues but that a better understanding of the concept is required as well as an understanding of the context within which the applications of innovation will be used.

7.3 Analytic lesson 3: Difficulty in measuring innovation

The third analytic lesson arising from the research is the difficulty in measuring innovation. This conclusion should not be surprising given the challenges in defining innovation and the lack of agreement on the concept.

Davila et al. note that specific measurements are critical to the success of innovation in an organization. They argue that objectives not met and strategies not implemented are those without clear measures developed at the outset (Davila et al 2006).

The field work found that while innovation is deemed important to each actor, the majority of organizations lack specific innovation objectives. Without objectives, innovation is difficult to measure. If objectives however can be viewed as expectations, it is fair to say that the organizations generally had expectations of innovation. Smith et al. in discussing socio-technical regimes argue that the expectations of the actors while not always compatible are a factor in the uptake of innovation (Smith et al. 2005). This implication will be further discussed below under the lack of policy dialogue.

The field work provided insight into two lines of thought regarding the measurement of innovation. The first and strongest argument was that it is very difficult to do so and

therefore has not been successful to date. The second argument put forward by only one interviewee is that innovation is not possible to measure. The latter argument is not supported in the literature or the rest of the findings of the field work.

The first argument, difficulty in measuring innovation, was a consistent theme throughout the analysis of the field work. The argument revolved around four factors that appeared to be a combination of several factors: 1) economic outcome pressures regarding innovation; 2) the complex nature of innovation; 3) the complex nature of preventative health; and 4) serendipity associated with innovation.

Economic outcome pressures impact the measurement of innovation. The Canadian government is a major investor in innovation. The longer time frame often required to realize benefits from innovation combined with the political reality of shorter government mandates makes it difficult to measure innovation at any given time. The timeframe for innovation which includes adoption for common usage can be lengthy. According to the primary research, innovation can take well in excess of ten years in the sector of focus. This point was discussed under Section 7.1. Politicians wish to see results within their mandates which in the federal system are usually four to five years.

Approximately $5 billion annually is spent federally on science and technology research alone (Policy Research Initiative 2010) in Canada. The challenge is that the political environment of the last five years has been one that demands extreme accountability for public spending. Governments are faced not only with measuring the economic and/or social benefit of that investment to validate their re-election efforts with little understanding of what they are measuring but are having to measure innovation part way through the evolutionary process.

This challenge is true for private industry as well. Typically, investors want to see results of their investment in four to seven years.

The literature supports the expectation of economic returns from innovation in the form of a competitive advantage. Innovation is expected to generate growth in economic terms for a company or an economy (Coates 2005; Davila et al. 2006; Department of Trade and Industry UK 2003; Dobni 2008; Etzkowitz 2005; Freeman & Louca 2001; Gray & Weseen 2008; Hamel 2003; Herath et al. 2008; Rheaume 2006; Pritchard & Burch 2003; Yakovleva & Flynn 2004).

Hamel notes that economic growth results from radical innovation (Hamel 2003) rather than incremental innovation. The focus of much of the food system and indeed many of the current companies in the FFNHP sector in Canada is incremental innovation as reported by the interviewees. The additional challenge is that as Freeman and Louca point out, innovation offers no guarantee of economic returns. If the benefit is accrued in areas such as power or influence the measures would be subjective at best (Freeman & Louca 2001).

The findings of the field work demonstrate that the pressure for economic returns is particularly difficult in publicly traded companies where shareholders demand significant short term increases in the value of their shares and are less prepared to invest in the long term future. The findings show that the higher the economic pressure, at least as it pertains to the food system, the greater the drag on innovation. This conclusion may be applicable generally to industries with relatively low margins.

The second factor causing difficulty in measuring innovation as identified in the primary research is the growing complexity of collaborations in research and development that occur across global networks. The findings demonstrated that research inputs into the innovation systems are becoming very specialized. They are occurring within and across industries as well as the natural and social science disciplines.

The literature recognizes the growing complexities in global networks (Castells 1996; Freeman & Louca 2001; Hobbs 2002; Hodgins et al 2004; Katz 2006; Pritchard & Burch 2003; Sankaran 2005; Yakovleva & Flynn 2004) and their impact on innovation. As Castells, Katz and Freeman and Louca argue, these networks are not only at the heart of innovation but have been established for innovation purposes (Castells 1996; Freeman & Louca 2001; Katz 2006). Conway and Steward also support the view that networks are an important element of the innovation process but caution that they are flexible, in flux and often informal (Conway & Steward 2009). The implication is that networks are often difficult to manage and therefore supports the view that the more complex and international the networks, the more difficult these innovation systems are to measure.

The impact of the complexities is that it will grow increasing difficult to measure where innovation occurs and to which actor, regime or region the innovation can be attributed. While innovation will be critical to address current and future global issues, investment in innovation will be required. Accountability and therefore measurement is necessary. The complex nature of innovation will require public and private enterprises to rethink financial instruments to support innovation in the future.

The third factor also relates to the complexity of preventative health. While interviewees attributed this difficulty particularly to the FFNHP sector, they recognized the growing body of evidence linking food and nutrition in general to health outcomes. This factor is consistent with the literature (Barling & Lang 2005b; Cash et al. 2004; Coleman et al. 2004; Coyte 2005; Friedmann 2004; Herath et al. 2008; Lang et al. 2009; Lang & Heasman 2004; Lussier 2005; Market Intelligence Group - Leatherhead Food International 2006; Nestle 2002; Schlosser 2004; Sleep 2006; Sparling 2010a, 2010b; Sparling & Cunningham 2010; Tansey & Worsley 1995). This point is expanded below.

The final factor challenging actors in measuring innovation is the serendipity nature of innovation. Serendipity can be a result of deliberate, purposeful innovation or an unintended positive consequence of events or actions occurring internally or externally to the organization. The field work demonstrated that serendipity plays a role in innovation. An example of serendipity of innovation was the health benefit derived by humans who ate the meat of animals who consumed an innovative feed targeting animal health. Serendipity is recognized in the literature as an element of innovation (CIHR 2006; Conway & Steward 2009; Yapps-Cohen 2000).

The difficulty in measuring innovation causes concern for both public and private policy-makers in determining where their interests should and do lie. Conway and Steward for example argue that measurement should be considered in the context of how innovation is perceived, successful or not successful, and who is measuring it (Conway & Steward 2009).

The primary research was consistent with the growing call in the literature for the need for various measures. Davila et al., similar to Conway and Steward, note that measures are an element of innovation (Davila et al. 2006) while Dobni places emphasis on measuring organizational capacity for innovation (Dobni 2006). While the measures are targeted at the company or organization, they have implications on public policy.

Katz argues that innovation systems are measured against each other, and primarily utilize three indicators: 1) research and development intensity, 2) gross domestic product per capita, and 3) the number of citations per paper. Countries primarily use the first two indicators as investment targets in research and development. For example, Katz notes Europe's 2010 goal of investing three percent of gross domestic product in research and development. This percentage is then compared to innovation systems of other countries. He argues that this metric does not present the right comparison as there are other factors in

play, such as scalability of research and development activities in each country and the unpredictable nature of social systems within systems of innovation. He argues that new thinking is required regarding metrics so that public policy is based on evidence (Katz 2006).

The literature however may be looking for measures that are absolute; that is measures that are clearly definable such as economic metrics. This research however indicates that measures are relative and are not easily compared to each other. The conclusion is that the field work supports the literature in calling for more investigation into understanding innovation measures. This finding is not unexpected since there is no common understanding of the concept of innovation. The implication is that actors in innovation must find better ways to gain a broader understanding of innovation, the goals and expected outcomes of innovation as well as the pathway to achieving them.

If innovation is approached from a solutions-led model, it may be easier to measure. For example, once a strategy is set out to address cardiovascular disease, then mortality rates, and health care costs are easily tracked. The statistics however may be a result of the combination of application of a number innovations and traditional approaches. The challenge is attributing outcomes to specific innovations that provide benefit. Therefore, new thinking is required not only in measuring innovation, but how it is measured.

The field work indicates that future measures of innovation will include the benefit to society in general which can then be defined in different ways. Social responsibility and ecological responsibility were both noted as measures of the future.

Social responsibility and ecological responsibility are measured but not considered a measure of innovation. Goldman Sachs for example reviewed the global food and beverage industry to measure the performance of companies in that sector in the area of environmental, social and governance utilizing its ESG framework (Goldman Sachs 2007). The company's ultimate goal is to use the framework to examine how these companies perform with respect to share value – again the link to economic returns for shareholders. The Goldman Sachs research shows that companies scoring high on ESG outperform companies that do not achieve those measures. Interestingly the leading driver of the ESG companies is innovation through the introduction of healthy products (Goldman Sachs 2007). It is difficult however to determine from the report exactly what it defines as innovation. The question is whether reformulation constitutes innovation. The results of the field work support the contention that reformulation should be considered innovation.

The public policy paradigm

The paradigm faced by public policy-makers with respect to measures of innovation is threefold: 1) what are the measures of innovation? 2) how should policy-makers balance risk and benefit? and 3) who measures innovation? Innovation with respect to the food system may result in outputs that meet Tansey and Worsley's measures of a good food system but are not compatible with the present societal values and beliefs. These authors argue that the measures of a good food system are safety, sufficiency, security, sustainability and healthy as well as providing enough food to all who require it (Tansey & Worsley 1995).

The future innovation measures with respect to the food system or food and nutrition demand network will increasingly look to societal, cultural and even theological measures and are therefore relative and difficult to quantify. Goodman and Redclift point to innovation that has resulted in manipulation of life forms in their discussion on innovation in biotechnology (Goodman & Redclift 1991). Regardless which side of the argument from which biotechnology is viewed, the criteria outlined by Tansey and Worsley do not address the appropriateness of the outcome of innovation in food and nutrition with respect to societal, cultural, ethical or theological values which will become accepted measures for innovation and consideration of policy-makers for the foreseeable future.

The argument therefore is that measures of innovation are not abosulte but relative. In other words, while innovation is currently deemed difficult to measure, it will likely grow increasingly difficult as criteria other than econometrics are demanded.

7.4 Analytic lesson 4: Lack of context-based, evidence-based policy-making in Canada relating to the functional food and natural health products sector

The field work demonstrated that federal policy as it affects innovation in the Canadian FFNHP sector is not context-based, evidence-based. The conclusion is that policy-making in Canada may be influenced solely by one factor within the context of the Lomas model (see Figure 8 on p.55): ideology of the political party currently in power.

Table 19 provides an overview of the requirements for effective context-based evidence based policy-making (CBEBPM) found in the literature and what is happening in Canada based on the findings of the field work. This section provides a more robust description of four key findings leading to the assertion that CBEBPM is not occurring in Canada: 1) lack of knowledge regarding innovation policy; 2) disconnect between and among institutions of

innovation; 3) lack of policy dialogue; and 4) lack of consideration of available evidence linking nutrition to health outcomes.

Table 19: Context-based, evidence-based policy-making and the Canadian experience

Statements on ...	... in the literature	... in literature with respect to Canada	... in findings of field work pertaining to innovation policy-making relating to FFNHP and food sectors
Dialogue	Required to: • Understand issues, address assumptions and explore policy options • Create a vision • Engage public	Required as the basis: • For establishing values and principles • For engaging all actors • To build trust • Creating a culture change required to enable innovation	Not occurring within government and with external actors Expectation that input translates into action
Values	Comprised of ideologies, beliefs, interests and ethics	Current government priorities of accountability, security, environmental protection and the economy	Political ideologies key (and perhaps only) consideration Economic value predominates
Vision	Subject to path dependency Lack of shared vision impacts translation of evidence into policies	Required to set objectives which are measureable National vision for science and technology but not innovation Call for a national vision and strategy linking health and nutrition	No vision known
Collaboration	Requires strong linkages among and within actors with understanding of context	Growing recognition for collaboration in research, business including international collaborations and government	No perceived collaboration occurring in innovation policy-making
Evidence	Used to inform decision-making Required to reduce policy failiure Provided by external actors	Need for better communication and translation of evidence on the part of evidence providers Evidence available linking health and nutrition but not acted on	Evidence perceived to be available to support policies enabling innovation but not perceived to be considered
Holistic approach	Required for complex issues and to build analytical capacity	Multifaceted nature of policy-making in Canada Principle of horizontality required	Policies appear to be done in silos
Analytical capacity	Required within government to understand evidence and put in context	Significant disparities at both federal and provincial levels	Required in both public and private sector
Tensions inhibiting decision-making	Political tensions Actor tensions Increasing complexity of issues Global influences Access to resources	Diverse nature of population concentrations Jurisdictional issues within and among federal and provincial departments Actor tensions with differing agendas Producer groups with most influence Global agreements	Exisiting within and among all actor groups
Power to make decisions	Held in political hands with input from other actors	Held by Prime Minister's Office and the Minister of Finance	Held by the Prime Minister

7.4.1 Lack of knowledge of innovation policy

The analysis of the field work indicates that the lack of knowledge of innovation policy is based primarily on the actors' lack of faith in the federal government to translate policy into action. The lack of faith was expressed particularly by industry interviewees.

Even within government, there was little support for its own ability to take coordinated action on its policy. The government interviewees provided the following factors as rationale for their observations: 1) lack of a common definition of innovation; 2) inconsistencies within departments regarding interpretation and measurements of the policies; 3) institutional mindset; 4) policies that lack substance; and 5) lack of consultation within government.

While the interviewees lacked knowledge of the policy in general, they were familiar with policy tools such as programs and regulations that affect innovation in the sector. This finding is consistent with G-6's observation that familiarity with policy may not be pertinent but rather how it affects each actor.

If policy is examined in that light, then it would be fair to say that the actors are familiar with the various policy tools such as programs and regulations that affect each actor. For example, the Scientific Research and Experimental Development (SR&ED) Tax program is appreciated and welcomed as a critical tool enabling corporate innovation activities. This policy tool provides cash flow to SMEs which allows them to continue their work. This program was clearly identified as one which the industry would like to see expanded. The program is consistent with Georghiou's supply-side policies that support innovation (Georghiou 2006).

Lynch however argues that tax policy in this area is costly to the country. He argues that the money received by the companies has not been invested in collaborative research projects or in the development of highly qualified personnel which will assist in meeting the innovation goal of increased competitiveness (Lynch 2010).

Other policy tools such as grants administered by the Natural Sciences and Engineering Research Council (NSERC), the Social Sciences and Humanities Research Council of Canada (SSHRC) and the National Research Council's Industrial Research Assistance Program (IRAP) were also specifically cited. The first two programs are of particular interest to the academic/research actors. In early

2011, however NSERC, the $1.1 billion university research funding agency in Canada, announced that research related to food would no longer be a priority area for it (Waldie 2011). In addition, funding for the Advanced Foods and Materials Network (AFMNet) will be not renewed as of April 2011.

The current accountability requirements associated with accessing funds from the various policy tools have resulted in many companies turning away from the programs due to the time and effort required for reporting purposes. The unintended consequences of increased accountability requirements within government is that leading companies in the FFNHP sector, companies that have the proven ability and capacity to commercialize technologies, are not turning to other actors of innovation for assistance. This point will be discussed below with respect to collaboration and policy dialogue.

Current regulations were also discussed by half of the interviewees. Whether the discussion was in the realm of barriers to innovation or policy tools that they believe need to be addressed, interviewees collectively argued that the current regulatory environment is a drag on innovation. They perceive Health Canada's focus weighs heavily on the side of safety rather than balancing safety with the public benefit they believe is derived from the consumption of functional food and natural health products. The findings of the research indicate that Health Canada, the regulatory body, is perceived as unnecessarily risk averse and more suited to the pharmaceutical or treatment model than the prevention model. As a result, the onus, resources and time required to complete the regulatory requirements may negate the very small new entrants with innovative concepts and products. As R-1 noted, only the larger companies can afford to have a person on staff dedicated to the regulatory process in Canada.

Tansey and Worsley argue that conflict in policy-making is inevitable but note that the wishes of the electorate must be met (Tansey & Worsley 2004). Smith et al. also point to conflict that arises out of differing visions for the future by the various actors (Smith et al. 2005). In this instance, the precautionary treatment based approach of Health Canada is at odds with the evidence-based, preventative model being promoted by other actors.

Smith et al. also argue that the actors with significant influence can wield power over direction in the governance of the regime (Smith et al. 2005). There is support for this

line of thinking in the literature (Goodman & Redclift 1991; Lang et al. 2009; Lien 2004; Nestle 2002). In the case at hand, Health Canada has worked with the pharmaceutical industry but is attempting to respond to the new preventative regime or solution oriented model linking food and health. The findings of the field work reveal that the precautionary approach associated with the pharmaceutical model is perceived by the FFNHP sector to persist and is being imposed by Health Canada and influenced heavily by the pharmaceutical sector. The pharmaceutical industry continues to be the primary beneficiary of the current regime and possibly at the expense of the public.

Tension exists not just between government and other actors but also within government. It is interesting to note that Cash et al. argue that agriculture and food policy has shifted from a focus on the production end to the consumption end (Cash et al. 2004). Those who set agricultural policy however are not the regulators. In Canada, Health Canada is the regulator laying the foundation for tension within government.

Tansey and Worsley suggest that to understand policy, it is important to identify the benefactors of policies (Tansy & Worsley 2004). The benefactors of the current regulatory environment are the pharmaceutical sector and the larger food companies, all of whom have sufficient and often dedicated resources to focus on regulations. Smaller companies struggle to deal with the current process. The research indicates that the larger the enterprise, the more the focus is on incremental or equipment/process technology innovation due to the emphasis on brand protection rather than the transformative innovation often found in the smaller enterprises. In other words, companies that can afford to work within the current regulatory environment are the ones focusing on incremental innovation while the small companies focusing on more radical innovation lack the resources to deal with the regulatory environment and the intended and unintended consequences of that environment.

Hobbs argues that to facilitate science and innovation, an *"enabling and transparent"* regulatory environment is required (Hobbs 2002). Actors across the triple helix twins agree that the regulatory process in Canada for FFNHPs must be simplified and requires a more timely approval system.

The implication is that under the current system, smaller SMEs will likely find it increasingly difficult to innovate. The WEF however regards business sophistication as an innovation pillar. It argues that the more sophisticated an organization, the better the opportunity for successful market introduction (Lopez-Claros et al. 2006). With the focus on economic outcomes for policy as noted above, it is likely that the system will continue to favour the larger company at the cost of transformative innovation.

7.4.2 Disconnect between and among institutions of innovation

The field work revealed a disconnect between and among actors and institutions of innovation in the form of a lack of collaboration in Canada. This disconnect has created tension beyond which is normally expected. Each actor group appears to view the other groups not as partners or collaborators in innovation, but rather as barriers to innovation.

Clearly collaboration within and among actors in the FFNHP and food sector in Canada is perceived as limited at best but is needed. Regardless of whether the discussion relates to Etzkowitz's triple helix twins of innovation in reference to actors or innovation processes or Katz's complex system of innovation, the literature concludes that collaboration or networks are deemed a foundational principle of innovation (Baber 2005; Bercovitz and Feldman 2005; Castells 1996; Etzkowitz 2005; Goodman & Redclift 1991) similar to that expressed by two of the six government actors participating in the field work. Both actors are senior federal government policy advisors. These interviewees argue that policies must be developed that facilitate collaboration or networks within or among actor groups due to the importance of that function within the innovation system.

Each actor group in the field work acknowledged the need for collaboration but stated that real collaboration is not occurring even though many of them are operating within specific Canadian clusters. With respect to industry, collaboration with other members in the actor group at the same stage of the demand network (e.g. both producing consumer ready products) was not seen in a positive light. Rather than providing value to them, the pervasive view of industry is that collaboration is an imposition placed on them by government.

Where the industry actors saw value of collaboration for innovation purposes was with members of their actor group but in differing stages of the demand network

using them for either inputs or outputs. The conclusion therefore is that industry views these relationships as business or contractual relationships rather than collaborative efforts.

In general, the innovation actor groups in Canada do not see the others as collaborators. Academia/researchers are perceived as following a research path that will keep their laboratories open. Government is perceived in adversarial terms. Industry sees other members primarily as competitors.

This point is not consistent with the literature. Castells argues that what he terms the *"network enterprise"* (p. 171) where companies collaborate to meet specific goals and then disband are particularly appropriate for industries that focus on innovation (Castells 1996). Goodman and Redclift provide a specific example that of the Agricultural Genetics Company (AGC) established in the 1980s in the United Kingdom. Its shareholders included Ciba-Geigy, Ultramar and Eli Lilly. The goal of the company was to commercialize publicly funded research and the shareholders were given first rights to access the research for their own purposes (Goodman & Redclift 1991). Another example is the DuPont and Bunge joint venture that worked to produce and commercialize a soy isolate ingredient, Solae (Hodgins et al. 2004).

If collaboration is occurring, the industry actors participating in the field work perceive it as being forced on them by government. Industry equates collaboration with government as access to public funds. As well, industry views its relationship with government as forced hardly lending itself to context-based, evidence-based policy-making.

The existence of tensions with respect to innovation within companies was also identified in the literature. The analysis of the research did not support the finding of Govindarajan and Trimble. They argue that collaboration within companies with respect to innovation is extremely challenging and can counteract innovation activities. Their focus was Fortune 500 companies (Govindarajan & Trimble 2010). None of the interviewees represented companies within that list, but those that represented very large international or multinational companies did not identify lack of internal collaboration as an issue or drag on innovation.

Other tensions among actor groups exist as well. With respect to the research community and government, the relationship is strained. Similar to industry

concerns, researchers/academics claim that the government's policy framework attempts to force collaboration between industry and research institutes with the sole goal of securing funding for the researchers. Interestingly, this 'collaborative' research is perceived as occurring on paper only but not reality.

With respect to the larger food industry, collaboration with the research community is limited. Research and development for the larger companies is perceived to be a liability due to low margins received from innovative food products. There is recognition that research and development does play a role in these large companies. For example, one of the larger food companies contracted with an academic/researcher in one of Canada's major universities which led to the introduction of a successful new product line. It was clear from the interview that while appreciated, the researcher was deemed to be a contractor in a business relationship with the company, rather than a collaborator.

Interestingly, there was support from both academia and government actors regarding the importance of collaboration within the research/academic actor group. Both actor groups discussed research that is being conducted in silos and that collaboration across fields of study is critical to innovation systems. Emerging fields of study are occurring resulting in the need for increased efforts in collaboration within academia and research. The findings of the research however indicate that industry perceives research lacking in focus and as noted above, spending their efforts attempting to secure funding in areas that may or may not be of interest or value to industry.

The actor groups therefore do not have similar or compatible goals with respect to innovation. This lack of collaboration represents another drag on innovation in the Canadian food system.

The other challenge identified with or within academia/research is that collaboration will increasingly occur on a global scale and will be commonplace in the future where new fields of science emerge. The concern expressed is the funding source for global collaboration as well as ownership of the intellectual property rights that spin-out from the research. This global collaboration within this actor field may lead to increased tension between it and the domestic government actors. The growing complexities and international linkages/collaborations will pose challenges for governments as they will find it difficult to identify the role Canada will play in the

complex systems. The challenge for government will be how resources are invested so that their constituencies realize and see benefit. And the challenge for researchers as perceived by some industry actors is that academia/researchers do not know how to collaborate with each other let alone with experts in other regions. This point is consistent with that made by Lussier and Sankaran (Lussier 2005; Sankaran 2005).

The academic/research community acknowledged the need to network across all actor groups. They argued that networking is at the core of collaboration. Collaboration however is not being achieved at this point in Canada. The findings indicate that there is a disconnect between all actor groups and particularly within the government actor group impacting policy-making.

Interestingly, Bercovitz and Feldman found that in reviewing the literature regarding the relationship among the actors in the triple helix, the universities (research) appear to be the focal point for innovation (Bercovitz & Feldman 2005). Under the current Science and Technology Policy, the overarching policy for all innovation policies in government, the government of Canada has invested heavily in academia/research. There is disagreement within the government actor group as to the appropriateness of this impact of the policy. The argument is that it leads to a science push approach to innovation. The policy implication is that it does not address the complex nature of issues being addressed by government which then requires a challenged/solutions-led approach or innovation systems approach (Steward 2010a).

Government is not immune to perceptions of lack of collaboration within its own actor group. While each government interviewee spoke of the importance of collaboration to innovation and policy-making, government interviewees from four different departments expressed concern that it was not happening even within their own departments let alone between or among departments. As well, they also saw research often conducted in silos within government institutes and by field of study. If that claim is true, then the lack of cooperation even at the government level is a drag on innovation in Canada.

Only one government interviewee spoke of collaboration in terms of sharing and recognized the value of it not as a drag but as a fundamental principle of innovation. He used the term social mechanisms that allow for opportunities to share and build on the capabilities and capacities of each actor group. In this instance, he was the

only person who really views collaboration as an opportunity for, rather than a drag on, innovation. The limiting factors on this requirement were identified as time and resources.

With respect to policy-making, the nongovernment actor groups recognized that government's role is to set policy. But they also see a collaborative role for themselves by providing input into the policy process. Government also sees collaboration through input as a vital role in policy-making. Government considers round table discussions as being a method to secure input into policy-making. This collaborative approach to policy-making is consistent with Halpern and Millstone's approach. As indicated previously, they argue that policy- making concerning science and technology cannot be made in isolation of other actor groups. While not focusing solely on industry, they argue for a collaborative approach between government (politicians) and experts that is a three step process where: 1) politicians set the goals for policy, 2) experts provide options based on knowledge, identify knowledge gaps and outline consequences of following the various options, and 3) politicians set the policy by choosing which course of action, which option, to take (Halpern & Millstone 2004).

The field work revealed that by providing input, non government actors expect their input to be incorporated into policies. They perceive that government either lacks the ability or interest in following through on the input that ultimately results in the disengagement by non government actors (academia/research and industry alike) in the policy-making process. This point will be expanded under lack of policy dialogue.

The conclusion is that actor groups are operating in silos and often silos within silos as was illustrated by the observation that even within government departments, collaborative efforts are at odds with one another. This lack of collaboration has implications both for innovation as well as policy-making in Canada.

From the perspective of innovation, the literature demonstrates the importance of collaboration due to the notion that innovation is based on interconnectedness and the multi-disciplinary nature of idea generation (Baber 2005; Bercovitz & Feldman 2005; Etzkowitz 2005). Jacob supports this view and notes that the interconnectedness of the various actors provides the environment required for innovation (Jacob 2006). The World Economic Forum also recognizes the value of

collaboration. But its focus on collaboration is between two actor groups - university and industry (WEF 2008a).

The key difference in the primary and secondary research is the acknowledgement of the participation of the public in innovation. The interviews clearly demonstrated that any consideration of the public is primarily in the realm of whether innovation provides a benefit to the user. The literature however argues for public engagement in innovation if society is to reap social benefit (Coates 2005; Etzkowitz 2004; Baber 2005). The public will become increasingly part of the discussion as citizen values, social responsibility and concern over global issues become enmeshed in the future criteria for assessing innovation.

The question that must be examined is the extent of the drag on innovation (with respect to the framework of this research) and its consequences as a result of the antagonistic relationship that exists among the actors of innovation in Canada.

7.4.3 Lack of policy dialogue

The final theme of the field work uncovered the perception that there is a lack of policy dialogue occurring in Canada. This theme is closely linked to the lack of collaboration among the actors. The interviewees believe they have a role in developing policy through participation at stakeholder meetings or industry roundtables held by the government. The concern expressed by the interviewees was that their input is not incorporated into policy and that no action is taken on setting policies.

Non government actors (industry, academic/research, NGO) regard dialogue as the precursor to action. They also view dialogue to be a foundation of collaboration. The literature suggests that collaboration is required in setting public policy (Coleman et al. 2004; Lussier 2005). But in the view of the interviewees, the current process is likely better described as consultative rather than collaborative.

Dialogue however is not equivalent to members of the triple helix twins providing input or being consulted. Collaboration relates to working together for a common purpose. Dialogue by its nature refers to a discussion among actors to gain a better understanding of an issue at hand and explore potential solutions in a mutually respectful manner rather than in an antagonistic mode.

Steward calls for more diversity in policy dialogue with respect to innovation. He argues that the large corporate actors have had significant power and influence in the development of policy targeting innovation under the science-push, linear model, the model that appears to be prevalent in Canada. He argues that a solutions' driven approach to innovation is required with dialogue and equal influence across the spectrum, including the civil society, innovators and regional or local actors (Steward 2010a). Smith et al. are in agreement of the need for a more holistic approach to innovation and a more inclusive requirement of all actors in its governance which includes dialogue (Smith et al. 2005).

The analysis of the field work argues that not only is there a lack of policy dialogue in Canada, the relationship within and among the actors in the triple helix twins appears to be adversarial if not contemptuous. The result has been significant tension among the actors and a lack of trust as indicated in the previous section.

This finding of conflict resulting in tension is not unexpected. Tansey and Worsley believe that conflict in policy-making is inevitable as a result of the interconnectedness of the actors (Tansey & Worsley 2004). Lang as well notes the tension in his depiction of Actor theory: A competition for influence in Figure 10 on page 63 (Lang 2010). Indeed there is a competition for influence in Canada as noted previously. Primary producers and large enterprises have significant influence over public policy affecting the food system.

Conflict is only expected to worsen in the future due to the growing role of science (Lien 2004). It will also increase as a result of the growing complexities of the innovation systems. For example, the analysis of innovation in the food system as outlined in Section 7.2 identified the advent of new technologies that spark among other issues theological debate. These new technologies will likely give rise to more rather than less conflict in policy dialogue making policy dialogue and opportunities for it even more important.

Of special note is the finding that the current policy environment in Canada is governed by fear. One impact has been that policy dialogue does not exist. The policy environment currently in Canada will do nothing but exacerbate the fear and conflict. A paradigm shift is called for in the policy environment that allows for meaningful dialogue with all actor groups including the public.

Conflict also arises in policy dialogue and policy-making when considering who is responsible for policy and to whom they are responsible. The government's responsibility in policy is to only one actor group within the triple helix twins – the public. The literature clearly identifies that government must act in the public interest (John 1998; Tansey & Worsley 2004). As well it must respond to the concerns of its citizens (Pentney 2006).

The interviewees including the politician interviewed for this research acknowledged the role of the public in policy-making. They concur that the primary impetus for policy change is the public and is accomplished through the political process. Lang also notes the importance of public opinion in influencing policy-making (Lang 2010). The political arm of the government listens carefully to public opinion and attempts to react to their concerns. Reacting to public opinion however may not always be in the public interest which is entrusted to government potentially increasing tension and conflict. Skogstad points out however that the desire for political survival at all levels of government sets the stage for conflict at the outset of policy-making (Skogstad 1987).

Conflict with respect to the political environment in Canada exists. Several interviewees expressed deep concern about the political dismantling of the Office of the National Science Advisor of Canada. The conflict is the result of the lack of dialogue regarding the options and the movement as they see of the innovation, science and technology policies away from a national agenda to that of a political agenda.

Political survival is not the only challenge. Lang and Heasman argue that tension can exist between public and industry interests which place the public interest in jeopardy. To reduce the risk of conflict, they suggest that policy input must be derived from across the food system (Lang & Heasman 2005).

Another area of conflict that inhibits policy dialogue is the perceived power and influence with government policy-makers. Two specific groups were identified as having significant lobbying power: 1) primary producer groups, and 2) large and multi-national enterprises. Both segments of the industry actor group were identified as wielding significant power with government and policy in Canada. The strength of these groups in policy dialogue and policy-making was also identified in the literature (Coleman et al. 2004; Coleman & Skogstad 1990b; Nestle 2002; Skogstad 1987).

Primary producer groups' power is recognized by the politicians at the voting booth while big business wields power from an economic perspective. This point was consistent with that made by Winson (Winson 1993).

The conclusion therefore is that discussions with the federal government with the goal of attempting dialogue appear to be more folly than fruitful.

It is not sufficient however to discuss the lack of policy dialogue without noting the internal challenge in government. As one example, industry actors identified the work that is conducted in silos within government as an impediment to this dialogue. Government interviewees themselves note there is development of innovation and science and technology policy without consultation or dialogue with other departments or within their own departments. This point is consistent with Lussier's findings. He argued for the need for horizontal policy-making in Canada (Lussier 2005).

The final point with respect to a discussion of conflict and lack of dialogue in policy-making is the disconnect that exists between Ottawa, the country's capital, and the rest of the country. The field work revealed that the disperse geography and diverse regional interests in Canada challenges the country's policy-making and governance. The literature concurs with this point. Coleman and Skogstad for example point to the multifaceted nature of policy-making in Canada that reflects the strengths and capacity of the various regions in such an expansive country. As well they argue that the division of policy-making between the federal and the multiple provincial and territorial jurisdictions weakens the ability to develop and implement policies that meet specific objectives of the country (Coleman & Skogstad 1990).

7.4.4 Lack of attention to evidence linking nutrition to health outcomes

Evidence is a significant contributing factor to policy-making. Davies identifies several influencing factors as depicted in Figure 7, page 53. At its core is or should be evidence (Davies 2004). Lomas also acknowledges the role of evidence in policy-making as outlined in Figure 8 on page 55 but does not place it in such a predominant role. He places it as just one piece of information that is balanced with values in the decision-making or policy-making process of government. Regardless of the weight given to it, evidence plays a key role.

As identified previously, sufficient evidence exists linking nutrition to health outcomes. The evidence however is not translated into policy suggesting that a combination of path dependency and the precautionary approach still exists with respect to health policy in Canada. This approach is a drag on innovation linking nutrition and health and favours innovation in pharmacology.

The findings linking nutrition and health are consistent with arguments found in the literature in general (Barling & Lang 2005b; Cash et al. 2004; Coleman et al. 2004; Friedmann 2004; Lang et al. 2009; Lang & Heasman 2004; Lussier 2005; Market Intelligence Group - Leatherhead Food International 2006; Nestle 2002; Schlosser 2004; Sleep 2006; Tansey & Worsley 1995). They are also consistent with literature targeting Canada. Sparling and Cunningham argue that while there is significant research linking nutrition to health outcomes, these results which they argue as evidence have not been translated into policy in the country. They continue that health and food policies have been developed in isolation of each other and argue for a paradigm shift to link the two policy areas. Research/evidence has formed the foundation for a shift from a treatment model to prevention model. The authors argue however that Canada has not acted on the research. They recommend that a policy shift must occur in both the public and private sector, individually and jointly, to meet the vision of a healthy Canada that results in both social and economic improvement (Sparling & Cunningham 2010).

The key challenge in this evidence is attributing specific health outcomes to any one preventative innovation since it is usually a combination of factors that results in specific outcomes. In addition to attributing specific factors, the benefit derived with respect to health may take years to identify and measure. The implication for public policy-makers whose focus is accountability within the timeframe of a government mandate, measuring treatment based innovations may be easier than prevention based innovations. Policy dialogue is therefore required however to explore combinations of solutions, all in the public interest.

7.5 Policy-implications

Policy by its very nature is reactive and slow to react. Innovation is about change that can occur rapidly and transform an industry, institution or way of doing something. The implication of the findings may be that any desired impact or outcome of current innovation policy in Canada is at best serendipitous. The

additional observation is that current innovation policy is based on a concept that is not well understood.

Analysis of the findings of the research adds new knowledge to the understanding of the phenomenon of innovation. The human elements of insight and imagination have been added to the emerging model of innovation to signify their importance as equal partners to invention and adoption into common usage in the multi-dimensional understanding of innovation as an evolutionary complex system. This research argues that innovation occurs at the convergence of these three elements. Insight and imagination in this context are defined collectively as the ability to understand the significance of and see opportunity in the convergence of disconnected systems or networks. More research is required in the human elements of innovation to gain a better understanding of their role and how policy can facilitate these factors.

In broader terms, the analysis of the field work supports a solutions-led or challenge led approach to innovation policy-making. This finding supports the general premise argued by Steward and Smith et al. where innovation policy requires solutions to complex issues not only for economic issues but particularly when expectations of social outcomes are present (Smith et al. 2005; Steward 2010a).

Support for this approach to food and health is also found in the literature. Lang et al. argue for a combined effort in public and private policy to enact change in food policy that results in positive health, social and environmental outcomes. Their argument therefore implies a solutions-led approach (Lang et al. 2009). With respect to Canada, Elmslie also argues for a more holistic approach, a systems approach, to nutrition policy-making that results in public health benefits (Elmslie 2010). Sparling also supports this approach for Canada but adds to public good benefits, expected economic outcomes (Sparling 2010b).

It should be noted that the initial results of the analysis of the findings of the field work suggested support for a policy-mix approach to innovation policy rather than solutions-led approach. This approach to innovation policy-making is argued by Flanagan et al. They argue that innovation policy transects various areas of policy so must include a mix from each factor (Flanagan et al. 2010). Georghiou offers a more detailed overview of the innovation policy-mix approach in what he terms supply-side and demand-side measures covering a mix of finance, services, systemic policies, regulations and procurement (Georghiou 2006). Gray and Weseen also followed a

policy-mix approach in their recommendations to AAFC based on their research on innovation in the Canadian food system (Gray & Weseen 2008).

Table 16 on p.282 provides an overview of the policy mix suggested by the interviewees in the field work. They identified a mix of policies or programs in capacity building, taxation, regulations and science and technology that they believe would enable innovation in the FFNHP and food sectors. These factors would appear to lend support for a policy-mix approach to innovation in Canada which would support incremental or semi-radical innovation as defined by Davila et al. (2006).

The findings however also reveal support for a paradigm shift in policy-making. They argue for the need for a new vision as well as a holistic approach to policy-making across government departments. They also suggest the need to make innovation policy a national agenda rather than a political agenda. In other words, they are calling for institutional change. Note that they did not suggest policy change at the private level which is also required in a solutions-led approach.

The concern over political control over policy is supported in the literature. Lien expressed concern over the growing influence of political interests in policy-making. She argues that the food system has expanded to such an extent, now including intricate networks and non traditional actors, that even the concept of the politics of food has expanded and requires new thinking (Lien 2004).

In addition to the call for a paradigm shift in policy-making, other factors from the findings must be considered as the basis for a recommendation of a solutions-led approach to innovation in FFNHP and food. There was general recognition among interviewees that sufficient evidence is available linking food and nutrition to health outcomes. The outcomes however are complex. As interviewees noted, health outcomes are difficult to attribute to one factor which adds to the complexity of the issue.

While economic benefit is seen as the primary outcome derived from innovation from all actors in the field work, social outcomes will increasingly be an important measure of innovation in the future. In this case, the social benefits will be a healthier population and a healthier environment. This supports Steward's point arguing that a solutions-led or challenge led approach is appropriate for societal issues that are

particularly complex (Steward 2010a). The increasing focus on social goals including the growing social, environmental and ecological concerns facing the globe also suggests that innovation is needed to meet those goals (Cerny 1997; Etzkowitz 2005; Nelson & Winter 1977).

The implications of international, complex demand and research networks that include non traditional actors require greater clarity of understanding. The findings suggest no solutions but call for a need for understanding. This point confirms the call for dialogue which is required among all actors to explore issues and options (Elmslie 2010; Smith et al. 2005).

Currently the actors of the innovation and policy arenas are not engaged. In addition, the non government actors are not interested in being engaged in discussing policy direction or policy options. These actors lack trust in the current system of policy-making and do not believe that they have a role in that system. A solutions-led approach with all actors may be required to gain interest, trust and collaboration. Dialogue will also assist in reducing the tensions that exist among the actors.

Against this backdrop, Government policy in Canada with respect to innovation is now left to various departments. The national Science and Technology Policy replaced the national Innovation Policy. And government policy with respect to the food system has focused on agricultural production. Attention to the system as a whole has been cursory at best. There is no national food policy in Canada. In addition, NSERC, Canada's largest research funding agency recently removed food as one of its priority areas.

The country and indeed the world face significant challenges into the twenty-first century. The world economy is based on fossil fuels which are damaging the environment. The Alberta (Canada) oil sands project, the second largest oil reserve in the world, continues to cause significant debate within the country and abroad. The issue is whether support should continue for its development.

Food costs are expected to continue to increase. Climate change variability is causing water scarcity and a decrease in arable land. Incidences of chronic disease related to nutrition choices are increasing particularly in the developed world. Nutrient content continues to be bred out of crops in favour of crops that are higher yielding and able to withstand transportation challenges. The world's population

continues to increase and is predicted to be concentrated in urban environments. Food availability is already an issue particularly in emerging nations and will only continue at crisis rates into the foreseeable future as populations swell.

The question is whether innovation can be a tool to mitigate impacts of the impending global structural crisis due to the convergence of these challenges. There are two fundamental issues in examining this question. The first is whether there is value in gaining a better understanding of, and agreement on, the concept of innovation. Secondly, if there is agreement on a common understanding of innovation, is there benefit to implementing policies targeting innovation that could positively address these global challenges.

Without a clear understanding and agreement on what constitutes or defines innovation – at best – policy expectations designed to enable innovation will not be realized. At worst, these policies will be counterproductive.

Innovation will not stop regardless of action or inaction in policy-making. Imagination and insight will continue to be part of the nature of humankind and the quest for new knowledge could also be serendipitous. This type of innovation is innovator-led.

The second pathway of innovation is deliberate innovation. In other words, the argument is that a solutions-led approach to innovation is deemed necessary to address global challenges.

Table 20 outlines the emerging concept of innovation and its relationship with the impending structural crisis facing the globe.

Table 20: Emerging model of innovation: a tool to address global challenges

	CONVERGENCE OF		= INNOVATION
	Evolutionary complex systems	**Insight and imagination**	**Adoption of invention**
Elements	Newness linked with change	Ability to understand significance of and see opportunity in convergence	Public and/or private benefit derived
Feedback Loop			

Global challenges:

- Inextricably linked nation-state economies
- Energy (fossil fuels)
- Rising food costs
- Food availability
- Food security
- Climate change variability
- Water scarcity (potable)
- Availability of arable land
- Chronic disease
- Declining nutrient value of food
- Population increases
- Urbanization
- Environmental human migration

Structural crisis on horizon

Innovation

1. Innovator-led
2. Solutions-led

Table 21 on the next page provides an overview of the pathway that supports a solutions-led approach to innovation which addresses one of the key global challenges, chronic disease – linking nutrition and health. Innovation policy is then set to facilitate the transformation required.

Table 21: A solutions-led approach to innovation in health and nutrition

Stage	Actor	Goal
Dialogue (throughout the process)	Government (to initiate) Research/academia Industry Civil Society	Build trust Agree on expected outcomes (food, health, environment, social, economic) Identify and explore complex issues Understand the context Identify and invite all actors Identify and validate assumptions Set goals Identify measurements of success Identify resource requirements Explore policy options
Conduct research	Research/academia Government as funders Industry	Secure the evidence on subjects identified Industry and government to build internal analytical capacity to understand and evaluate the evidence
Set policy	Government Research/academia Industry	Develop policies and programs that: Facilitates innovation Prepares the users for change
Take action	Government Research/academia	Ensure that policies are acted on the address both supply and demand issues of the 'solution'

The table demonstrates that government must take the lead in initiating this approach. The field work shows that there is no interest from non government actors to be engaged with government due to a lack of trust. Gaining that trust may be the biggest challenge for the solutions-led approach.

Public policy-makers will also be challenged to develop policy and policy tools that support the benefits of innovation. Government must accept its role as a facilitator in the development and maintenance in a policy and regulatory environment that readily and effectively enables industry to deliver the results of innovation to the general public.

Another challenge for public policy-makers will be to develop policy and policy tools that provide benefit to Canada from innovation. This holds true for countries whose industry profile is similar to that of Canada. Capturing benefit will grow increasing difficult as innovation, the evolutionary complex systems, becomes more complex. But this point is not new. Goodman and Redclift also recognized the challenge two decades ago of capturing the benefit of innovation, in their examination - biotechnology - within the jurisdiction from where it was developed (Goodman & Redclift 1991).

CHAPTER EIGHT – Reflections

> *"As bad as our policies are, nothing is going to stop innovation entirely. We set up the world based on the past, but innovation by definition means something new. Innovation is always going to present new challenges for our policy framework and unless we have some way of creating and modifying our policy environment, we will create barriers to innovation. We have to figure out how to pay attention to innovation policy and get industry and government, and even consumers together to figure out how to advance it. And I wish we were in an environment for public discussion, debate on policy, but I don't see it … We live in an environment of fear right now." A-2 (Senior Academic Policy Researcher)*

8.0 INTRODUCTION

Chapter Eight provides personal reflections on the inquiry into the phenomenon of innovation and a policy environment that enables it. It argues that even if the Canadian policy-making environment does not change to respect the value and benefits that innovation could bring to the value-added food system, innovation will continue due to the growth of new knowledge that adds to the concept of innovation, the human element.

This chapter also argues that future research is required that will add to the richness derived from the evidence presented in the previous chapters. Future research lies in four primary areas. First, government must fund new academic multi-disciplinary research testing the emerging model of innovation to gain a broader understanding of the policy implications. Second, government must fund academic research to understand the serendipity on innovation. Third, government must test the solutions-led approach – a systems innovation approach – to innovation policy-making. Fourth, academic research must investigate the full impact of the lack of policy dialogue in Canada.

Finally, industry must also take responsibility for future action. Influential business and academic leaders who have political influence with the political party in power must join forces to work with the political arm of government to encourage dialogue that will result in changes needed to support innovation.

8.1 Achievements of the research

This research succeeded in two key areas: 1) adding new knowledge that broadens the understanding of innovation to include a human element; and 2) identifying a new approach to policy-making that is not present in the current regime in Canada.

The debate and exploration of the innovation phenomenon is evolving. The research has proven that innovation is complex and multi-dimensional. The current policy regime in Canada is deemed to be a drag on innovation. As a result, the Canadian value-added agri-food system may not be optimizing the potential benefits of innovation even though the sector currently has pockets of innovation at the company level. With respect to the Canadian functional food and natural health products sector, the research found that some new and unique functional foods and natural health products are perceived to be innovative. Many products or technologies however in this sector are not considered innovative. Like other sectors, many of the products are simply copied or have small value-added variations.

Cold-FX is the example of innovation in the sector that was most touted by the interviewees. It is a product of Afexa Life Sciences Inc. in Edmonton, Alberta. The vision for the product was that of Dr. Jacqueline Shan, originally from China and working at the University of Alberta in the early 1990s. Dr. Shan believed that western science could be married with traditional medicines (e.g. Chinese, aboriginal) to provide natural health products that meet the rigor of Western medicine. Her insight and imagination applied knowledge from the pharmaceutical sector that led to the invention of the technology that standardized the amount of active ingredient in a natural product resulting in the immunity-building product Cold-FX. That achievement had never been done before. Cold-FX is now Canada's leading cold remedy and therefore meets the final component of the innovation definition being adopted for use.

On the global front, the probiotic drink Yakult is one the most widely recognized nutraceutical (natural health product) innovations. It was developed in Japan by Dr. Minoru Shirota. Dr. Shirota sought a way to address the many digestive-system related illnesses suffered by the Japanese in 1930s. By 1935, the product was on the market and is now available in thirty countries (Yakult 2010). As a result of his insight and imagination he invented the first probiotic drink that contains beneficial bacteria that promote gut health.

The emerging concept of innovation incorporating the human element must be tested. The evidence derived from the field work shows that policy advisors within

government do not agree on the emerging concept of innovation resulting in a myriad of policies and programs that are or become a drag on innovation.

More research is required on the human element to gain a better understanding of how some people have insight – are able to connect the dots – to imagine and make change for social and/or economic benefit. If these qualities are innate rather than learned, then research with respect to these human elements would examine their relationship with innovation and how those elements could be channelled for benefit to society.

Irving Stone's *The Agony and the Ecstasy*, the extensively researched biographical novel of Michelangelo di Lodovico Buonarroti, the great Renaissance engineer, architect, sculptor and painter speaks to the mindset of an innovator. Michelangelo's innovation output (e.g. sculpture of David, artistry of the Sistine Chapel, design of sections of Rome and St. Peter's Basilica) was as a result of a convergence of several domains as he viewed it: art, anatomy, structural engineering, geology, psychology, history, theology to name but some domains of interest. With respect to his insight and imagination, Stone articulated it in terms of ideas. Sebastiano asks Michelangelo *"But how do you get the idea in the first place?"* Michelangelo replies *"Perhaps ideas are a natural function of the mind, as breathing is of the lungs? Perhaps God puts them there? If I knew the origin of men's ideas, I would have solved one of our deepest mysteries?"* (Stone 1961) p.559.

The novel was not used in the analysis of the research. It is used here simply to articulate a point. What makes one person possess ideas or insight and imagination that when applied, can result in positive change in the world while so many others lack that capability? It also addresses an argument made by some company presidents that capacity for innovation is required within their human resources. One of Canada's recognized, leading innovators in the food and functional food industry participated in the field work. He bemoaned the point, at least in his view, that the current nutrition and food science programs at universities are destroying all creativity and imagination in the graduates. He argued these programs train them in processes and hinders his company's ability, and indeed that of the sector in general, to continue down a path of innovation.

Research has been conducted in the area of imagination in education. One such example is a book entitled *Engaging Imagination and Developing Creativity in*

Education. The book is edited by Kieran Egan and Krystina Madej and published by Cambridge Scholars in 2010 in Newcastle and addresses some of the concerns expressed during the field work. The main issue however is that this area has not been examined in the literature with respect to innovation.

The World Economic Forum also looks at innovation capacity in countries. Its closest linkage to personal attributes is ranking the number of engineers and scientists in a country. Does this measure however speak to technology or science policy, or innovation policy? Authors such as Baber, Bercovitz and Feldman, Dobni, Etzkowitz and Munn-Venn have examined an organization's environment that enables and facilitates innovation and it includes an organization's capacity and capabilities (Barber 2003; Bercovitz & Feldman 2005; Dobni 2006; Dobni 2008; Etzkowitz 2005; Munn-Venn 2006). The literature however does not acknowledge the level of importance of the innovator.

This research found that the human aspect of innovation is not given the credibility it is due. There is a passion and excitement associated with innovation that was omnipresent in the interviews but was difficult to translate into hard evidence in reporting the findings. The passion and mindset must be further explored to test and understand its role in innovation that results in public and private benefit.

With respect to a new systems-led approach to innovation linking nutrition and health that seeks population, environmental and societal health outcomes, the complex challenges facing the global population today require a multi-faceted complex approach. Systems innovation is required. The goal of achieving the intended outcomes will result in deliberate innovation.

As well, the research discovered tensions and disconnects among and within the actor groups beyond what was expected. The policy arena as it pertains to the Canadian functional food and natural health and food sector lacks collaboration, dialogue and trust. The issues are complex. Innovation systems are complex. The current approach to the development of innovation policy is no longer apropos. A new solutions-led approach therefore is required.

The first and most obvious first step to a solutions-led, systems innovation approach is to enter into dialogue with all actors. Policy must focus on agency – implementation of policies that result in public or private benefit (Smith et al. 2005).

But agency cannot occur without dialogue across the system and it must include all actors. Government must facilitate the process.

Government must also find a policy entrepreneur within industry to lead the process. It will not be an easy task and generating trust within and among the actor groups will be the first priority. An industry leader who is respected and is perceived to be an innovator will bring credibility to the process and be critical in drawing the industry and academia into dialogue with the government. The champion must be found who can engage all actor groups, including the political wing of government. Dialogue will be the first step in building the trust that is required to build a common vision. Without doing so, a solutions-led, systems innovation approach will not occur.

8.2 Changes in the research based on hindsight

In retrospect, the scope of the research was ambitious. A more in-depth analysis of the concept of innovation is necessary. Evidence informs policy. The evidence to date however has been that innovation is not well understood. While this research broadens the understanding of the complex nature of the concept, a more robust investigation across additional sectors would better inform national innovation policy-making.

As the food system moves towards a focus on health, there will be further blurring of the difference between food and the functional food and natural health product sector. Differentiating factors will be reduced further. There may have been more value in examining innovation in the Canadian FFNHP sector with one of three other options: 1) the non food bio sector (e.g. bioenergy, bioplastics, biocomposites); 2) the FFNHP sector in another country such as Finland or Japan; or 3) the high technology sector.

A comparison of innovation in a sector with agricultural and marine inputs that result in non food products may have offered a better comparison to shed light on innovation which faces similar input challenges particularly with respect to nature but where the end product does not have the emotional connection that is present in food.

The second option would have proven interesting since Japan has long accepted functional foods in its culture and has a strict regulatory environment. Finland focused on a deliberate approach to innovation by attempting a solutions-led systems

innovation approach to address a high mortality rate due to cardiovascular disease in that country. Either option would have proven interesting and had significance in examining the policy environment in Canada and among the three countries.

The third option is the comparison with the high technology sector. This sector has proven to celebrate innovation that has resulted in cultural and societal change. Comparing innovation in nutritional products with that of high technology may have offered more distinct findings and lessons learned. The regulatory environment for this sector is assumed to be significantly different therefore options one or two would have been favoured over this one.

In addition to comparing the FFNHP sector to different sectors, the policy portion of the research would have focused on policy dialogue rather than an all encompassing policy environment that enables innovation. This point will be discussed further below.

8.3 Opportunities for future research

The findings of the research call for further research in four distinct areas, two of innovation and two of policy.

The first call for research is into the mindset of an innovator. The government should fund new academic research to test the emerging model of innovation to gain a broader understanding of the policy implications. The consequence of not testing the model is that the outcomes of the current innovation policy or any new policy may not be achieved to the intended extent. This point assumes that innovation indeed has value.

While research has been conducted on the psychology of creativity or imagination, the literature on innovation does not link that research or its implications to innovation. The model will only be proven or disproven if it is tested. Assuming the model is proven, the full impact of the finding on policy-making must be understood.

The research team testing the model is advised to approach it from a multi-disciplinary approach which could include researchers in the areas of psychology, science, sociology, ethics, business and education. It may include other fields as well but this approach is consistent with the complex nature of innovation and would ensure that the mindset of the innovator is examined in a multi-faceted way.

Secondly, government should fund research to understand the impact of serendipity on innovation. The literature sheds little light into the strength of serendipity and yet the field work identified this as an important factor. Serendipity is associated with the impact of random or unexpected events that affect an outcome both positively or negatively. A better understanding of the extent or role of serendipity in innovation would assist in understanding the practical expectations of innovation policy goals. Additionally, deliberate innovation will result from a solutions-led approach to policy-making in innovation. It is unclear as to the impact of serendipity on innovation under that approach.

Thirdly, the Canadian government must reflect on this research to determine if its approach to policy-making in the value-added food sector and innovation is appropriate. Many scholars in the country have called for change. The government must not only examine its current policy mix approach but also test the solutions-led, systems innovation approach to policy-making that would include outcomes beyond economic which is the predominant theme of the current regime.

Fourthly, the government must fund research exploring the lack of policy dialogue in Canada. The dialogue must include traditional and non traditional actors. The policy dialogue could examine the issue of whether formalized public policy actually enables or inhibits innovation.

The crux of the policy dialogue question would be: what is meaningful policy dialogue in the Canadian context with respect to innovation in the food and nutrition sector? And how can it be achieved? Evidence will need to be gathered to determine the depth of the problem.

One of the major challenges to the dialogue may be seeking the public's input. As Lang, Barling and Caraher point out, the public interest must be represented but it is a challenge to ensure that it is the public's interest rather than that of consumerism that is at the table (Lang et al. 2009).

With respect to achieving policy dialogue, another current challenge in Canada is the antagonistic and fearful environment described by the interviewees for this research. And finally, can policy dialogue result in agency?

Innovation in the FFNHP and food sector is increasingly targeting health and wellness. It involves complexities resulting from the convergence of health, environmental and societal challenges in developed and developing nations (Lang et al. 2010).

Regardless whether Canadians wish to target population health and reduce the incidence of chronic diseases, or the more all encompassing challenge combining health, environmental and societal outcomes, it requires more research along the lines of what Steward terms sociology of interaction. He argues we need to find supporting evidence. It requires not just dialogue on innovation with respect to food and nutrition, but other areas as well to ensure a holistic perspective (Steward 2010a). Innovation in nutrition is only going to be one part of the equation in a healthy population, a healthy society and a healthy environment.

Innovation in nutrition will be critical to the debate due to the cultural limits placed on the acceptance of the outcomes of innovation in the sector. Developments in science and technology have resulted in the advent of new sciences and technologies such as biotechnology, nanotechnology and genomics and brought to the forefront of the debate the social and ethical questions surrounding their impact on society. These technologies build on knowledge. New domains of science and new technologies will continue to develop. The question is how to capture benefit from these new domains for the benefit of society.

Industry and academia must also take responsibility for initiating dialogue. The current system that includes the think tanks currently operating in the country does not seem to be resolving the issue of the lack of dialogue. Policy-making in Canada is now held with the Prime Minister's Office and the Minister of Finance. Influential business and academic leaders who have influence with the current Prime Minister must join forces to either work with the political arm of government to see the benefit of dialogue, or begin the dialogue without government present. The latter option is not preferable, but it will start a process that will set the stage for change when the Government changes power.

8.4 Personal thoughts

When I began my journey along the pathway towards a PhD, the global economy was growing. The countries known as BRIC (Brazil, Russia, India and China) were gaining traction and interest from developed nations. The world in general was

optimistic about its future economic health. Times have changed. In 2008, the most significant downturn in the world economy since the Great Depression of the 1930s occurred putting social and environmental concerns in a secondary position for governments and also many citizens.

The field work was conducted in 2008 at the cusp of the economic downturn. While the economic changes would have impacted many of the interviewees in varying ways, the expectation is that it would not have significantly changed the responses to the questions posed. They may have had additional thoughts on the policies that could enable innovation. I expect however that the focus would have been to expand the programs that provided access to funds. That assertion would require testing.

Innovation will not stop. The evidence of the research concludes that crisis is one of the main drivers of innovation. The implication is that the findings of the research remain valid regardless of the change in the world economy.

The research therefore has implications not only for Canada but also for countries of similar capabilities and capacity in innovation in the high value-added demand network. The status of the Canadian value-added food demand network encompassing the FFNHP sector is comprised primarily of SMEs with some large international enterprises. These few large, international companies are not in the realm of the global powerhouses such as Nestle, Pepsico, Unilever, Proctor & Gamble although many of these MNEs have branch plants in Canada.

My professional career has been as a consultant to all actors of the innovation system in Canada. Over the last two decades, my work has provided input to policy-makers at both the federal and provincial levels of government. My interest in innovation and an enabling policy environment was formed during that time. I therefore began my research with a view that I would miraculously provide the policy-makers with evidence and recommendations for innovation policy that would ease the commercialization burden of discovery and invention.

As an academic researcher, I have gained a different view of understanding a research question and the implications of it. I used my professional network to gain access to seasoned actors across the triple helix twins within that policy environment. These actors were elite with history, experience and knowledge.

These actors expressed extreme concern over what they perceive to be happening in the policy environment in Canada. Even the government represented by public service actors raised deep concern. These concerns are reflected in the lack of faith in agency and the lack of dialogue that is occurring in Canada. One question that should be investigated is whether it is any different in other countries and the implication of it.

The evidence therefore shows that there is a current disconnect between and within the actors in Canada. And it is a significant disconnect. In addition to the words spoken, I observed extreme discomfort and anger on the part of the actors. Even though the literature notes that conflict is inevitable, I deemed it to be significantly more than should be expected.

The elevated tensions were present within the public service for the frustration in which they view their ability to influence public policies and processes. Similarly, these frustrations were also present within academia and industry. The elevated tensions in these two actor groups were directed at both the public service and the political arm of government. This tension does not bode well for a respectful dialogue on innovation, public health or any other policy.

8.5 The pathway forward

With respect to innovation, public policy in Canada appears to be focusing on a science-led model rather than a solutions-led model. While there are some public servants who see the need for a different approach, the question is whether they will be heard. The lack of engagement in Canada at this time is striking.

The opportunity is for substantive change. Innovation is not going to stop simply because of its personal nature and the human quest for new knowledge as noted in the field work as an addiction. The field work revealed excitement and passion aroused in the interviewees in all actor groups but particularly at the company level. It may be that some innovators leave this country because of its policies or the policy environment, but innovation will not stop.

Policy is intended to address issues of interest to the public. Unintended consequences however can occur as a result of policy. Cash et al. for example found that agricultural policies in Canada do not take into account a goal of population health. And yet, the very source of a major contributor to citizen health is

the agricultural community (Cash et al., 2004). Lussier and Sparling are also calling for new policies that place agriculture at the crux of a healthy Canada (Lussier 2005; Sparling 2010b).

Population health should be at the very heart of public interest, although the current focus is in the context of the healthcare system. With an aging population and an increasing percentage of our GDP devoted to health care, the pendulum is moving somewhat back towards preventative health.

The research provides evidence that a new approach to policy-making is required. It involves systems innovation as well as systems of innovation to meet the expected outcomes of the new approach. There is immense richness that will be derived from future research adding to the current evidence.

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