

**Cleantech SMEs' Expectations and Perceptions of an
Established Community-Based Intermediary Moving into their Sector**

**by
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Abstract

Innovation intermediaries provide a range of services to assist firms during the process of innovation. How SMEs perceive innovation intermediaries is an area of investigation that would provide important information on how innovation intermediaries' assist small and medium enterprises (SMEs). This study focuses on the cleantech industry and explores SMEs' expectations and perceptions of an established community-based intermediary (CBI) moving into their sector. A qualitative research methodology was adopted to collect data from 15 sample SMEs. In regards to SMEs, the findings show that cleantech companies face financing, partnerships, marketing, sales, regulatory and bureaucratic challenges. In regards to innovation intermediaries, the findings showcase how CBI, a regional intermediary, is not effective in supporting cleantech SMEs with their sector specific needs or challenges.

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1. Introduction

This research study explores small and medium enterprises' (SMEs) expectations and perceptions of innovation intermediaries whose objectives are to assist SMEs with their challenges and present them opportunities for advancement. Innovation intermediaries such as research and development (R&D) performers, property-based enablers, technology transfer and commercialization entities, economic development organizations, industry associations, and business financing and support programs provide a range of services to assist firms during the process of innovation (Dalziel, 2011; Howells, 2006). Innovation intermediaries have been getting more attention in recent literature as they start to get recognized as important players in a System of Innovation (Dalziel, 2010; Sapsed et al. 2007). How SMEs perceive innovation intermediaries is an area that requires further research as it would provide pertinent and important information towards learning how innovation intermediaries can assist SMEs more effectively. Moreover, developing a greater understanding of what SMEs' perceptions of innovation intermediaries are could contribute in supporting or building on innovation intermediary theory.

This study attempts to increase the understanding of SMEs' perceptions of innovation intermediaries. To achieve this, the study will focus on the cleantech industry and will explore cleantech SMEs' expectations and perceptions of an established community-based intermediary (CBI) moving in their sector. The study's main purpose, research question, and research design will be discussed in more detail in the following sections. Apart from building on existing literature on SMEs and innovation intermediaries, exploring this area of research will also contribute towards management practices and policies of SMEs and innovation intermediaries.

The introduction is continued in the next couple of subsections that discuss the importance of innovation, the motivation behind this study, the statement of purpose and main research question.

1.1 System of Innovation & the Importance of Innovation

The System of Innovation (SI) concept states that firms do not innovate in isolation, but in collaboration and interdependence with other organizations, such as firms, universities, venture capital organizations and governments (Edquist, 2005). Therefore, SI can be conceptualized as a network of firms and other economic agents who, together with the institutions and policies that influence their innovative behaviour and performance, bring new products, new processes and new forms of organization to the market.

To understand the importance of SI, one first has to understand how innovation can bring significant benefits at the country, industry, and firm level. From a country's standpoint, it can be stated that the wealth of a country is enhanced by its ability to conduct research to produce inventions and to commercialize them successfully in the market, thereby creating new value and enhancing wealth creation. As a result, successful adoption of an innovative culture in a country can have positive effects on its productivity, GDP, economy, and the standard of living (Lundvall, 1993; Nelson, 1993). This view is supported by the Institute for Strategy and Competitiveness based at the Harvard Business School (2011):

"A nation's prosperity depends on its competitiveness, which is based on the productivity with which it produces goods and services. Sound macroeconomic policies and stable political and legal institutions are necessary but not sufficient conditions to ensure a prosperous economy. Competitiveness is rooted in a nation's microeconomic fundamentals—the sophistication of company operations and strategies and the quality of the microeconomic business environment in which companies compete."

Successful implementation of an innovative culture can also provide benefits at the sectoral or industry level (Malerba, 2004). Healthy competition increases the pressure on firms within an industry to adopt a proactive approach in terms of developing or improving products. Moreover, new or improved products can increase demand in the

specific industry which in turn improves the standard of living in a society. The connection between how competitiveness within an industry can stimulate the innovation process in firms is supported by Edquist (2005) through the following:

"The competitive race between firms stimulates innovation, and this innovation lowers costs and improves product quality in the industry, and thereby increases industry demand. All firms benefit that contribute successfully to what is often combined and interactive process of innovation" (p. 545).

At the firm level, organizations have to be ready to face any challenges or adopt any modernization. The innovation process can result in new products, new processes, and cost recovery amongst other benefits. With this said, an innovative culture can often be the difference between a successful and not-so-successful organization. An organization with an innovative culture is more likely to expand rapidly than an organization without this understanding. As discussed by Porter and Linde (1995), "detailed case studies of hundreds of industries, based on dozens of countries, reveal that internationally competitive companies are not those with the cheapest inputs or the largest scale, but those with the capacity to improve and innovate continually" (p.98).

The importance of innovation signifies the need to have a well-developed SI. The role of innovation intermediaries in SI is increasingly being recognized as an important one as even the most innovative firms may not have the necessary capability or resources to do all they need to do to innovate successfully (Bessant & Rush, 1995; Dalziel, 2010; Sapsed et al. 2007). Innovation intermediaries play an important role in bridging "other actors with information, knowledge and still more actors" (Sapsed et al., 2007, p.1315); at the same time, innovation intermediaries also provide a range of direct services which go beyond the accustomed bridging or connecting role (Howells, 2006). These direct services are designed to assist SMEs throughout the different stages of the innovation process.

1.2 Motivation: Canada's Innovation Challenge

With increasing globalization, Canada's competitiveness, like that of other countries, hinges on the ability of its industry to commercialize new products and technologies. Many efforts have been made by the government and innovation intermediaries, including non-profit organizations like industry associations and research institutes, have been set up to address this challenge. With regards to government initiatives, there are about 100 federal programs that support innovation and commercialization activities which are managed by some 25 federal departments or agencies (Expert Panel, 2006). When it comes to non-profit organizations, although there is not an accurate number, Dalziel (2007) approximates that there are about 10,000 innovation-related nonprofits in Canada with mandates that address scientific, technological, or business objectives.

However, according to several innovation and commercialization studies, Canada is falling behind in comparison to its Organisation for Economic Co-operation and Development (OECD) partners. These studies include *How Canada Performs* by the Conference Board of Canada in 2008 and *Innovation and Business Strategy: Why Canada Falls Short* by the Council of Canadian Academies in 2009. In particular, Conference Board of Canada 2008 study provides a credible annual report-card in partnership with OECD. The report card grades the top 17 wealthiest countries by 6 categories: economy; education and skills; health; society; environment; and innovation. Based on Conference Board of Canada's (2008) findings, Table 1 presents Canada's performance in each category and provides the ranking compared to its 17 OECD partner countries.

Table 1: How Canada Performs - 2008

Category	Grade	Position out of 17 Countries
Economy	B	11 th
Education & Skills	B	2 nd
Health	B	10 th
Society	B	10 th
Environment	C	15 th
Innovation	D	13 th

Note. Adapted from *How Canada Performs: A Report Card on Canada*, In *Conference Board of Canada*, 2008, Retrieved March 15, 2010 from <http://www.conferenceboard.ca/e-Library/abstract.aspx?did=2763>

As can be observed, Canada falls in the middle of the pack in general but receives its lowest grade when it comes to innovation. In the innovation category, Canada is ranked 13th, higher than Austria, Australia, Italy and Norway but falls well short of standards set by top innovative countries such as the U.S., Switzerland, Japan, and Germany. In the report, innovation refers to ‘the creation, diffusion, transformation and commercialization of knowledge to make new or improved products’ (Conference Board of Canada, 2008). To provide an analogy, Table 1 presents a report card of a talented student, i.e. Canada, who is underperforming when it comes to the subject of innovation.

Furthermore, according to the Conference Board of Canada, Canada has consistently been receiving a ‘D’ grade in innovation through the 1980s, 1990s and 2000s. The Conference Board of Canada uses key indicators in providing its grade in the innovation category and these include: Scientific articles, Technology exchange, Patents per population, Share of world patents, High and medium-high technology manufacturing, Knowledge-intensive services, Export market share (Aerospace, Electronics, Office machinery and computers, Pharmaceuticals and Instruments) and Top 100 brands.

Despite the efforts of the government and innovation intermediaries, these results illustrate that Canada has not improved on its innovation grade since the 1980s. SMEs make up 99.7% of companies in Canada and, thus, have the potential to make important contributions to Canada’s innovation performance (Statistics Canada, 2010). This leads to the need for a good understanding of government and innovation intermediary efforts to optimize the effectiveness of their programs and services designed to support SMEs’ innovation and commercialization activities. The present research was done to contribute to that understanding.

This study focuses on innovation intermediaries and, more specifically, investigates SME managers’ perceptions of an innovation intermediary in assisting them with their innovation and commercialization challenges. Developing this understanding will provide insight on SMEs’ perspective on innovation intermediary efforts and provide

important information to organizations of the same class, i.e. SMEs and innovation intermediaries, in developing or improving their products and/or services. The next section outlines the statement of purpose and main research question of this study along with relevant subquestions.

1.3 Statement of Purpose & Research Question

My research study explores SMEs' expectations and perceptions of innovation intermediaries whose objectives are to assist SMEs with their challenges and present them with opportunities for advancement. To achieve this, I conducted interviews with SME managers in the cleantech industry to investigate their expectations and perceptions of an established community-based intermediary (CBI) moving in their sector.

Background information on the cleantech industry and CBI are provided in section 2.4.

It is important to note a couple of key facts regarding the cleantech SMEs selected for this study's exploration. Firstly, I investigate cleantech SMEs who try to be innovative or, more specifically, who are trying to introduce or implement a product, process, marketing, or organizational innovation. Secondly, I investigate cleantech SMEs who have used one or more services offered by CBI.

In general, the services provided by innovation intermediaries, such as CBI, should assist SMEs to overcome challenges or to present potential opportunities contributing to the development and/or commercialization of SMEs' innovations. My research approach was a qualitative research methodology primarily reliant on conducting interviews.

Statement of Purpose:

To understand whether a community-based innovation intermediary is meeting the expectations of cleantech SMEs in assisting them overcome their challenges.

Main Research Question:

My study explores the following main research question:

- ➔ What are cleantech SMEs' expectations and perceptions of an established community-based intermediary moving into their sector?

Research Subquestions

The following are the subquestions relevant to answering the main research question:

- 1) For which challenges do cleantech SMEs seek assistance from innovation intermediaries?
- 2) What are the cleantech SMEs' perspectives on CBI assisting them overcome their challenges?

Investigating SMEs in the new but maturing industry of cleantech would provide important insight as to what these SMEs expect and how they perceive an innovation intermediary supporting the growth of the sector.

The research study is organized through the following sections. Section 2 covers definitions relevant for this study, the industry of focus, the intermediary of focus, and an overview of the venture capital industry. Following this, section 3 presents the literature review and section 4 covers the research methodology for this study. Section 5 presents the findings and section 6 provides a discussion comparing the findings with extant literature. Lastly, section 7 concludes the study with contributions, implications, limitations and future research.

2. Definitions, Intermediary of Focus and Industry of Focus

For the purposes of this study, it is important to define innovation and its various types along with innovation intermediaries. A model for the innovation process is also presented.

2.1 Innovation Definitions

I find the innovation definition proposed by the Oslo Manual (2005) adequate for my study and it is as follows:

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.

The minimum requirement for an innovation is that the product, process, marketing method or organizational method must be new (or significantly improved) to the firm.

Furthermore, the Oslo Manual (2005) identifies the various types of innovation in the above definition as follows:

- **Product innovation:** *the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.*
- **Process innovation:** *the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.*

- **Organisational innovation:** *is the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations.*
- **Marketing innovation:** *the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.*

Innovation can also be categorized as either radical or incremental. Amongst various definitions, the Council of Canadian Academies (2009) provides definitions for radical and incremental innovations and this is presented in the following:

- **Radical Innovation:** *associated with creating entirely new markets. "The economic benefits (jobs and growth) of a blockbuster innovation usually diffuse broadly and rapidly beyond the firm and location where the innovation originates". Classic examples of radical innovations include the steam engine and the automobile.*
- **Incremental Innovation:** *connected with established markets. "Incremental innovation – in which developments are typically 'new to the firm', or perhaps to a sector, but not 'new to the world' – is what drives productivity growth and firm competitiveness in established markets. Incremental innovations can simply be cost reductions, improvements to existing product lines, or additions to existing platforms".*

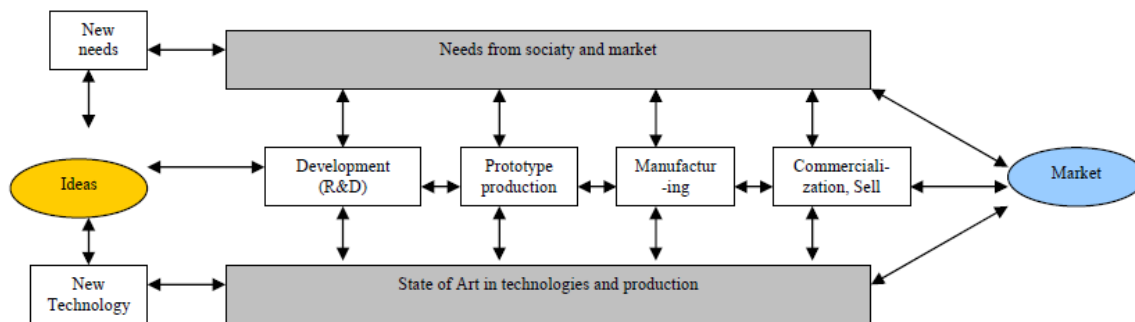
Literature on innovation and its various kinds is also presented in the literature review section to supplement this section.

2.2 A Model for the Innovation Process

Work by Rothwell (1994) presents how the perception of the innovation process has evolved from the 1950s to present. The innovation process was perceived as a linear or phase-by-phase process in the 1950s but today it is understood to be an interactive

process where different components interact with each other, both internal and external to a firm. Figure 1 displays the interactive innovation process model developed by Rothwell and Zegveld (1985). It should be noted that this model is specific to a technological product innovation.

Figure 1: The Innovation Process



Note. From *Reindustrialization and Technology* (pp.50), by R. Rothwell & W. Zegveld, (1985), London: Longman Group Limited.

Although not the latest innovation process model developed, the model displayed illustrates very well the process SMEs undergo during innovation. The interaction of the different components in this model is best described through the following:

“...a logically sequential, though not necessarily continuous process, that can be divided into a series of functionally distinct but interacting and interdependent stages. The overall pattern of the innovation process can be thought of as a complex net of communication paths, both intra-organizational and extra-organizational, linking together the various in-house functions and linking the firm to the broader scientific and technological community and to the marketplace. In other words the process of innovation represents the confluence of technological capabilities and market-needs within the framework of the innovating firm” (Rothwell & Zegveld, 1985, p.50).

2.3 Defining Innovation Intermediaries

For this study, I am going to use the innovation intermediary definition proposed by Dalziel which is as follows:

“Innovation Intermediaries are organizations or groups within organizations that work to enable innovation, either directly by enabling the innovativeness of one or more firms, or indirectly by enhancing the innovative capacity of regions, nations, or sectors” (2010, p.3).

While this definition is similar to other proposed definitions, it is purposely more abstract to include a range of innovation intermediaries. In her definition, Dalziel “intends for innovativeness to be understood in the broadest possible sense, such that other words such as success, growth, competitiveness, adaption, or even survival could be substituted” (2010, p.4). It should also be noted that the innovation intermediary may or may not be involved in technological innovation.

Innovation intermediary functions or services and innovation intermediary types are discussed in the literature review section.

2.4 Innovation Intermediary of Focus

The innovation intermediary that is the focus of this study is a community-based intermediary (CBI) in Canada. The identity of this innovation intermediary is disguised for the confidentiality of the organization and its name and location will be referred to as CBI and City 1 respectively.

CBI is a non-profit, regional economic development organization that has a partnership with the corporate entity of the municipal government in City 1. Specifically, CBI’s partnership with the municipal government comprises of developing long-term strategies

and plans aimed towards developing and advancing the business climate of City 1. Having done this, CBI's primary responsibility is the implementation of these long-term plans while the municipal government's role is to oversee CBI's progress and execution. Apart from collecting membership fees, CBI is financed through municipal, federal and provincial government contributions as well as private sector contributions.

Founded in the 1980's, CBI started out as an intermediary with a particular focus on supporting the high-tech industry and established its credentials by initiating partnerships, policies and programs geared towards the economic development of the region. Since its inception, CBI has added other industries as part of its long-term objectives and has over 700 member companies it services. CBI presently supports small, medium and large sized companies across industries including telecommunications, contact/customer centre, photonics, security, life sciences, film and television, digital media, and cleantech amongst others.

Recognizing that environmentally friendly innovation encourages economic development, CBI decided to support cleantech SMEs to promote and strengthen the clean technology industry in City 1. CBI's range of services to support cleantech SMEs includes networking activities, access to capital, market intelligence, and business development services.

2.5 Industry of Focus: Cleantech

Recent reports indicate that the cleantech industry in Canada is evolving and maturing rapidly. The cleantech industry presently generates \$2 billion in revenue and has been growing at an annual growth rate of 47% during 2008 and 2009 (The Canadian Clean Technology Coalition, 2011). Furthermore, the projected annual growth rate from 2010 to 2012 is 117%. At this annual growth rate, the cleantech industry is on a trajectory to reach \$10 billion by 2015. While industries such as aerospace and defence took many decades to build, the cleantech industry has taken just 15 years so far with the potential of

reaching the same scale as aerospace and defence in a shorter period of time (Globe-Net, 2011; The Canadian Clean Technology Coalition, 2011).

The cleantech industry promises prosperity despite the most challenging economic environment in the last few years. Studies conducted by OECD (2011) and the United Nations' Sustainable Energy Initiative Public Finance Alliance (2009) signify the following economic benefits resulting from clean energy and technology programs:

- There is a strong positive relationship between clean energy/energy efficiency/environmental investments and economic prosperity and job growth.
- Government spending on clean energy and technology programs is more effective in creating jobs than equivalent spending on conventional energy alternatives programs.
- Green stimulus programs generate about three to four times as many jobs as tax cuts do.
- Other economic and environmental benefits include reducing pollution and greenhouse gas emissions, saving energy, reducing energy costs, and reducing energy price fluctuations.

Innovation intermediaries have the potential to play a key role in sustaining and driving the growth of the cleantech industry in Canada. This study explores what SMEs' expectations and perceptions are of CBI moving into their sector. Investigating SMEs' perceptions of CBI would provide important insight and a reference point in understanding how innovation intermediaries are supporting an industry that encourages environmentally friendly economic development, which is the way to the future.

For the purposes of this study, it is important to define a clean technology company. Sustainable Development Technology Canada (SDTC) provides the following definition which I have adopted for this study:

“A company that is predominantly engaged in the development and marketing and/or use of its proprietary technology to deliver products or services that reduce or eliminate negative environmental impacts, and address social needs;

while delivering competitive performance, and/or using fewer resources than conventional technologies or services” (2010, p.40).

This definition is appropriate for this study as it focuses on companies that produce innovative products or technologies that reduce negative environmental impacts. It should be noted that there are some companies, such as utilities, which are referred to as cleantech because they generate power from renewable sources although they may not own intellectual property or patents, or invest in R&D with the intent of commercializing a unique, technology-based product (SDTC, 2010). These categories of companies have been excluded as the purpose of this study is to focus on companies that practice innovation or engage in innovative activities.

Generally speaking, the potential of this maturing industry has created the expectations of innovative products or technologies, making the cleantech industry all the more relevant for the purposes of this study. In 2009, there were more than 400 operating companies across nine sectors of the cleantech industry, generating an estimated \$2 billion in revenue and employing over 5,000 Canadians (SDTC, 2010; “Nurturing a Powerhouse Potential,” 2011). Table 2 provides examples for each of these nine sectors along with the number of Canadian companies within each sector (“Cleantech Defined,” 2011; SDTC, 2010). In addition, Table 3 breaks down the number of cleantech companies in Canada by sector and region.

Table 2: Cleantech Industry Sectors and No. of Companies in Canada

	Cleantech Industry Sectors	No. of Companies
1.	Biofuels and Biochemicals: feedstocks, harvesting, conversion, production, biomass	37
2.	Power Generation: solar, wind, hydro, geothermal, fuel cells, tidal	70
3.	Energy Infrastructure: management systems, infrastructure, storage, smart grid	8
4.	Energy Efficiency: building, lighting, glass	55
5.	Process Efficiency and Abatement: nano and biomaterials, pollution prevention and emissions control	73
6.	Recycling and Waste: recycling, material handling and	61

	sorting, hazardous waste elimination, energy from waste	
7.	Remediation: contaminated sites and brownfield redevelopment	21
8.	Transportation: zero- and low-emission vehicles and “clean” components, abatement, emissions reductions for moving vehicles	38
9.	Water and Waste Water: purification, treatment, infrastructure, conservation	73
	Total	436

Note. The data in column 2 are from Nurturing a Powerhouse Potential, In *Impact, Spring 2011*, 2011, Retrieved June 28, 2011 from <http://www.cleantechimpact.ca>. The data in column 3 are from 2010 SDTC Cleantech Growth & Go-to-Market Report, In *Sustainable Development Canada*, 2010, Retrieved May 14, 2011 from <http://www.sdtec.ca/uploads/documents/en/CLEANTECH%20REPORT.pdf>

Table 3: Cleantech Companies by Industry Sector and Region

Cleantech Industry Sectors	Atlantic	British Columbia	Ontario	Quebec	Alberta	Saskatchewan	Manitoba	National
Biofuels and Biochemicals	2	12	9	4	5	2	3	37
Power Generation	7	23	13	8	13	4	2	70
Energy Infrastructure	1	2	2	0	1	0	2	8
Energy Efficiency	6	14	19	8	5	3	0	55
Process Efficiency and Abatement	3	6	17	21	22	2	2	73
Recycling and Waste	2	10	17	17	13	2	0	61
Remediation	2	2	8	3	4	1	1	21
Transportation	1	14	9	7	2	1	4	38
Water and Waste Water	4	12	18	27	7	4	1	73
Total	28	95	112	95	72	19	15	436

Note. Adapted from 2010 SDTC Cleantech Growth & Go-to-Market Report, In *Sustainable Development Canada*, 2010, Retrieved January 28, 2013 from <http://www.sdtec.ca/uploads/documents/en/CLEANTECH%20REPORT.pdf>

Process efficiency and abatement, water and wastewater, power generation, recycling and waste, and energy efficiency sectors have the most populated number of companies. As observed, these five sectors have more than 50 companies each and make up more than 75% of the cleantech population. Energy infrastructure is the smallest sector which should be a cause for concern considering Canada has 20 electricity generation companies (The Canadian Encyclopedia, 2013). In terms of region, Ontario has the largest population of cleantech companies followed by British Columbia, Quebec, and Alberta.

Cleantech companies across the nine sectors can be segmented by business model in the following way (SDTC, 2010):

- 284, or 65% of the total, are technology product companies that require low start-up capital ranging from \$1 million to \$30 million and aim to commercialize to a large customer base.
- 136, or 31% of the total, are technology-enabled companies that require low start-up capital ranging from \$1 million to \$30 million and aim to commercialize to a small and particular customer base.
- The remaining 4% are divided between large-scale (9 companies) and distributed processing companies (7 companies) that require high start-up capital in the range of \$100 million. Also, large-scale processing generation companies aim to commercialize to a small customer base whereas distributed processing companies aim to commercialize to a large customer base.

These findings indicate that a majority of companies do not require high start-up capital outlays and, therefore, the cleantech industry presents Canada the opportunity for capital-efficient economic development.

In terms of innovation, 74% of cleantech companies were initiated to commercialize the founder's invention while only 8% were established to commercialize innovations developed in academic institutions (The Canadian Clean Technology Coalition, 2011). In terms of age, 77 companies have been operating for 5 years or less, 78 companies have been operating for 6 to 11 years, 63 companies have been operating for 11 to 15 years,

and 140 companies have been operating for more than 15 years (SDTC, 2010). Table 4 provides the average age of cleantech companies by industry and region.

Table 4: Cleantech Companies Average Age by Industry and Region

Cleantech Industry Sectors	Atlantic	British Columbia	Ontario	Prairies	Quebec	National
Biofuels and Biochemicals	n/a	16	23	8	14	16
Power Generation	18	9	19	8	27	11
Energy Infrastructure	4	16	8	21	n/a	13
Energy Efficiency	14	10	12	10	21	17
Process Efficiency and Abatement	19	13	12	14	22	16
Recycling and Waste	14	17	22	16	19	19
Remediation	12	26	13	12	24	15
Transportation	17	18	8	32	20	18
Water and Waste Water	8	16	16	12	21	17
Total	13	15	14	14	19	15

Note. Adapted from 2010 SDTC Cleantech Growth & Go-to-Market Report, In *Sustainable Development Canada*, 2010, Retrieved January 28, 2013 from <http://www.sdtec.ca/uploads/documents/en/CLEANTECH%20REPORT.pdf>

As observed, the average age for cleantech companies across the nine sectors is 15 years. Sector wise, power generation and energy infrastructure are the youngest sectors at average ages of 11 and 13 years respectively. The oldest sectors are recycling and waste (average age 19 years) and transportation (average age 18 years).

Although the average Canadian cleantech company is 15 years old, only 25% of them have mature distribution channels while 75% have no distribution networks or under-developed distribution channels (SDTC, 2010). Out of the nine sectors, transportation, process efficiency and abatement, and recycling and waste have relatively-established distribution channels. The fact that these are also the oldest sectors indicate that venture capitalists may be more inclined to invest cleantech companies when they reach a certain scale.

Supply chain networks differ considerably across the nine sectors. For example, biofuels and biochemicals rely on local supply chains while sectors such as process efficiency and abatement rely on foreign suppliers (SDTC, 2010); however, 80% of companies from the other sectors have mixed values chains between local and foreign regions.

The cleantech industry is reaching an important stage of commercialization. Table 5 provides a snapshot of cleantech companies by commercialization stage. As observed, 74% of companies are engaging in product commercialization that consists of either building their commercialization processes or scaling and optimizing them.

Table 5: Cleantech Companies by Commercialization Stage and Sector

Cleantech Industry Sectors	Research & Development	Technology Development & Demonstration	Product Commercialization & Market Development	Market Entry & Market Volume	Total (100%)
Biofuels and Biochemicals	1 (3%)	13 (35%)	8 (22%)	15 (41%)	37
Power Generation	4 (6%)	23 (33%)	19 (27%)	24 (34%)	70
Energy Infrastructure	0 (0%)	2 (33%)	1 (17%)	3 (50%)	6
Energy Efficiency	3 (5%)	7 (12%)	19 (33%)	28 (49%)	57
Process Efficiency and Abatement	2 (3%)	13 (18%)	25 (34%)	33 (45%)	73
Recycling and Waste	4 (7%)	11 (18%)	14 (23%)	32 (52%)	61
Remediation	1 (5%)	3 (14%)	7 (33%)	10 (48%)	21
Transportation	3 (8%)	10 (26%)	14 (37%)	11 (29%)	38
Water and Waste Water	4 (5%)	10 (14%)	12 (16%)	47 (64%)	73
Total	22 (5%)	92 (21%)	119 (27%)	203 (47%)	436

Note. Adapted from 2010 SDTC Cleantech Growth & Go-to-Market Report, In *Sustainable Development Canada*, 2010, Retrieved January 28, 2013 from <http://www.sdtec.ca/uploads/documents/en/CLEANTECH%20REPORT.pdf>

There are, however, numerous challenges cleantech companies face for successful commercialization. The biggest barrier companies' face for commercialization is the unwillingness by governments or businesses to purchase domestic clean technology. The

following briefly looks at the barriers or challenges cleantech companies face for commercialization (Deloitte, 2009; The Canadian Clean Technology Coalition, 2011; UNEP SEF Alliance, 2009):

- **Historical Energy Policies and Regulations:** Regulatory structures and policies in Canada have favoured fossil fuels and nuclear energy historically. For example, subsidies and tax policies favour nuclear and fossil fuel technologies and this allows nuclear and fossil fuel energy to be sold at lower prices.
- **Fragmented industry and market:** The markets for various cleantech sectors are relatively new and immature and, moreover, they often compete against mature and conventional energy technologies. Furthermore, some customers and markets do not put strategic importance on environmental benefits provided by cleantech products.
- **Lack of knowledge and technical skills:** Consumers, investors, suppliers, complementary product manufacturers, and planners lack knowledge on clean energy projects and products. Moreover, customers and suppliers may have insufficient expertise and resources to support installation, operation, and maintenance of cleantech products.
- **Financing challenges:** Cleantech companies' have difficulty accessing credit and can also face higher interest rates compared to conventional energy projects. Financing challenges are compounded due the fact that clean energy projects can cost more and provide lower returns on investment, as they are subject to higher uncertainty, than compared to conventional energy projects.
- **Discriminatory grid policies:** Utility companies may engage in discriminatory grid policies that inhibit or discourage cleantech companies or clean energy projects. For instance, utility companies may not allow cleantech companies adequate transmission access or may charge high prices for transmission access.
- **Administrative barriers:** Cleantech companies face administrative challenges accessing government programs for activities such as R&D. In addition, they have to deal with restrictions placed on siting and construction for clean energy technologies such as wind turbines, solar, and biomass. These restrictions are in place to address concerns relating to noise, unsightliness, and safety.

2.5.1 Governments' Role for the Cleantech Industry

Canadian governments have an important role to play for the development and growth of the cleantech industry through two main ways: Regulatory Framework and Direct Investment. Firstly, governments have a key role in developing and implementing the regulatory framework that can help develop and shape markets for new technologies. As with other countries, this is important for cleantech companies in Canada as they have to adhere to the regulatory framework developed by governments. Regulations pertaining to cleantech companies in Canada are divided between the provincial/territorial and federal governments while municipal governments play a limited role through local utility and distribution companies. Table 6 provides an overview of the jurisdiction division of responsibility between the federal, provincial and municipal governments that is relevant for the cleantech industry.

Table 6: Canada's Multi-Jurisdictional Division of Responsibilities

Government Level	Division of Responsibilities
Federal Government	• Resource management on frontier lands • Uranium and/or nuclear power • Interprovincial and/or international trade and commerce • Trans-boundary environmental impacts (includes air pollution, waterways, and land) • Other policies of national interest including economic development, energy security, and federal energy science and technology
Provincial and Territorial Governments	• Resource management within provincial boundaries • Intra-provincial trade and commerce • Intra-provincial environmental impacts (includes air pollution, waterways, and land) • Generation and Transmission of electrical energy • Conservation and demand policies • Local utility and distribution companies
Municipal Governments	• Local utility and distribution companies

Note. Adapted from Overview of Energy Status and Regulations in Canada, In *Natural Resources Canada*, 2009, Retrieved February 4, 2013 from <http://www.nrcan.gc.ca>

To provide an example, a cleantech company that is looking to implement a wind energy project may have to go through the following regulatory approval process:

- Access Land
 - Municipal regulations
 - Provincial or federal regulations if crown land
- Interconnection with local utility companies
 - Municipal/Provincial regulations:
 - Subject to regulatory authority requirements
 - An impact study is usually conducted
- Environmental impact assessment
 - Birds/bats pre-construction monitoring
 - Noise study conducted
 - Public Consultations
 - First Nations Consultations

Secondly, federal and provincial governments in Canada have developed programs to assist cleantech companies in establishing markets. These programs mainly comprise of direct investments through project and operating subsidies. The following are examples of federal investment programs for cleantech sectors (SDTC, 2010; The Canadian Clean Technology Coalition, 2011):

- **ecoAgriculture and ecoEnergy Programs:** Both programs are targeted for the biofuels sector. The ecoAgriculture program has a budget of \$200 million to support the construction of biofuel production facilities. The ecoEnergy program has a budget of \$1.5 billion and provides production subsidies to biofuel sector companies.
- **ecoEnergy for Renewable Power Program:** With a budget of \$1.5 billion, this program provides renewable power financing companies a subsidy of \$0.01 per kilowatt hour. This program has assisted 10% of the total cleantech companies in Canada by increasing domestic demand for power generation companies.
- **Clean Energy Fund:** Has a budget of \$1 billion with \$492 million assigned for carbon capture and sequestration research, \$200 million assigned for pre-commercial technology demonstration and delivery projects across Canada, and \$150 million for research and development activities.

- **Green Infrastructure Fund:** Has a budget of \$1 billion targeted for five of the nine cleantech sectors: Water and wastewater, power generation, energy infrastructure, recycling and waste, and the carbon transmission and storage companies within process efficiency and abatement sectors.
- **Tandem Fund:** Venture capital fund initiated by the Business Development Bank of Canada and Export Development Canada, both crown corporations. This fund was created to make more venture capital available for companies engaged in commercialization, market development, and market entry or market volume.
- **SDTC Initiatives:** Founded in 2002 by the federal government, SDTC has completed fifteen funding rounds totaling \$464 million to 183 projects.

Lastly, there are other government programs designed to support Canadian companies across various sectors including cleantech. These programs include the Industrial Research Assistance Program (IRAP), the Scientific Research & Experimental Development (SR&ED) Tax Incentive Program, and the Idea to innovation Program.

2.6 Overview of the Venture Capital Industry

The venture capital (VC) market is an important source of financing for SMEs until a company goes public, is bought out, or is able to access conventional financing methods. However, venture capital market activity has been declining in Canada since the tech bubble burst. VC invested \$5.88 billion in 1,007 Canadian companies in 2000 and these numbers dropped to a total investment of \$1.04 billion in 337 companies in 2009. Table 7 provides the VC investment history for Canada and the U.S. from 1998 to 2011.

Table 7: VC Investment Activity for Canada & the U.S. from 1998 to 2011

	Canada			United States		
Year	Total VC Investment (Million CDN Dollars)	Total Companies Financed	Average VC Deal Size (Million CDN Dollars)	Total VC investment (Million US Dollars)	Total Companies Financed	Average VC Deal Size (Million CDN Dollars)
1998	\$1,511	807	\$1.87	\$21,511	3,733	\$5.76
1999	\$2,617	810	\$3.23	\$54,960	5,605	\$9.81
2000	\$5,876	1,007	\$5.84	\$105,205	8,042	\$13.08

2001	\$3,747	720	\$5.20	\$40,974	4,591	\$8.92
2002	\$2,583	663	\$3.90	\$22,129	3,202	\$6.91
2003	\$1,613	615	\$2.62	\$19,680	3,020	\$6.52
2004	\$1,677	545	\$3.08	\$23,235	3,217	\$7.22
2005	\$1,699	558	\$3.04	\$23,612	3,300	\$7.16
2006	\$1,701	406	\$4.19	\$27,607	3,885	\$7.11
2007	\$2,051	402	\$5.10	\$31,875	4,212	\$7.57
2008	\$1,406	388	\$3.62	\$29,947	4,168	\$7.18
2009	\$1,039	337	\$3.08	\$20,383	3,141	\$6.49
2010	\$1,129	357	\$3.16	\$23,319	3,624	\$6.43
2011	\$1,510	444	\$3.40	\$29,480	3,943	\$7.48

Note. The data in columns 2, 3, and 4 are from Canada's Venture Capital Market in 2011, In *Thomson Financial*, 2013, Retrieved February 1, 2013 from <http://www.canadavc.com>. The data in columns 3, 4, and 5 are from Venture Capital Performance, In *National Venture Capital Association*, 2013, Retrieved February 1, 2013 from <http://www.nvca.org>.

As can be observed, the trend of VC investment in Canada is similar to that of the U.S., which also experienced declining investment since the tech bubble burst. Since 2009, VC activity in Canada has been showing encouraging signs. The total VC invested in 2011 was \$1.51 billion which is a 50% increase from the \$1.04 billion invested in 2009. A total of 444 companies secured one or more rounds of VC financing in 2011 with an average of \$3.40 million invested per company. This is an increase from 2010 where 357 companies were financed with an average investment of \$3.16 million. Meanwhile, VC investment in the US in 2011 was \$29.48 billion which is about 20 times the Canadian total. A total of 3,943 companies secured financing in the US in 2011 with an average deal size of \$7.48 million, which is about twice as large compared to their Canadian counterparts.

The story is similar when it comes VC investment in energy and environmental technology sectors in Canada and the U.S. VC investment in Canadian energy and environmental technology sectors has been rising steadily with a total investment of \$245 million in 2011 which is a 43% increase from 2010 and about the twice the amount invested in 2009. The \$245 million was invested in 48 companies with an average \$5.10 million per company. In comparison, VC investment in U.S. energy and environmental technology sectors in 2011 totaled \$4.6 billion, about 19 times that of Canada, with 348

deals. The average investment deal for a U.S. company was \$13.22 million, more than twice the amount Canadian energy and environmental technology companies received.

The breakdown of VC investment in all Canadian companies by province and industry sector is provided in Table 8 and Table 9 respectively. In terms of province, Ontario, Quebec, and British Columbia received the largest proportions of the total VC investment. In terms of industry sector, information technology companies received the largest share of VC investment with \$692 million, almost 46% of total investment.

Table 8: VC Investment by Province

Province	Million CDN Dollars		
	2009	2010	2011
British Columbia	161	220	226
Alberta	62	67	74
Saskatchewan	33	13	16
Manitoba	7	16	25
Ontario	296	426	550
Quebec	429	370	549
New Brunswick	26	11	21
Nova Scotia	25	10	47
Prince Edward Island	0	0	0
Newfoundland & Labrador	18	0	2
Territories	0	0	0

Note. Adapted from SME Research and Statistics, In *Industry Canada*, 2013, Retrieved February 1, 2013 from <http://www.ic.gc.ca>.

Table 9: VC Investment by Industry

Industry Sector	Million CDN Dollars		
	2009	2010	2011
Life Sciences	216	299	343
Information Technologies	497	492	692
Energy and Environmental Technologies	122	171	245
Other Technologies	14	32	28
Traditional	187	137	202

Note. Adapted from SME Research and Statistics, In *Industry Canada*, 2013, Retrieved February 1, 2013 from <http://www.ic.gc.ca>.

Note. Adapted from SME Research and Statistics, In *Industry Canada*, 2013, Retrieved February 1, 2013 from <http://www.ic.gc.ca>.

Table 10 provides the breakdown of the total VC investment in Canadian companies by the stage of development. An interesting and revealing finding in this table is how a large proportion of VC investment was with companies in the later stages of their development. In 2011, VC invested \$135 million in the seed/start-up and other early stages of

companies' development, 8.94% of total investment. On the other hand, VC invested \$1.08 billion in the later stages of companies' development, 71% of total investment. This indicates how VC are less inclined to invest in the early stages of a company's lifecycle and tend to invest in companies in the later stages of their development who may have demonstrated potential and have a solid foundation.

Table 10: VC Investment by Stage of Development

Stage of Development	Million CDN Dollars		
	2009	2010	2011
Seed/Start-up	230	136	135
Other Early Stages	228	322	298
Later Stages	578	672	1077

Note. Adapted from SME Research and Statistics, In *Industry Canada*, 2013, Retrieved February 1, 2013 from <http://www.ic.gc.ca>.

Lastly, exits of Canadian VC backed companies in 2011 consisted of 23 Merger & Acquisition (M&A) exits and 2 Initial Public Offering (IPO) exits. The average transaction size for disclosed M&A deals in 2011 was \$245 million and the average IPO offer amount was \$72 million. Table 11 provides the VC backed companies' exits for Canada and the U.S. from 2001 to 2011.

Table 11: M&A and IPO Exits for Canada & the U.S. from 2001 to 2011

	Canada				United States			
	M&A Exits	Average M&A Deal Size from Disclose Deals (Million CDN Dollars)	IPO Exits	Average IPO Offer Amount (Million CDN Dollars)	M&A Exits	Average M&A Deal Size from Disclose Deals (Million US Dollars)	IPO Exits	Average IPO Offer Amount (Million US Dollars)
2001	43	\$13.00	8	\$19.00	353	\$101.80	41	\$85.10
2002	34	\$77.00	3	\$14.00	318	\$52.10	22	\$95.90
2003	24	\$39.00	2	\$40.00	291	\$62.80	29	\$69.80
2004	39	\$90.00	14	\$38.00	339	\$83.00	93	\$118.40
2005	45	\$52.00	9	\$67.00	347	\$95.80	56	\$79.70
2006	29	\$78.00	7	\$20.00	363	\$110.60	57	\$89.80
2007	37	\$104.00	12	\$61.00	488	\$153.70	92	\$134.40
2008	23	\$62.00	1	\$33.00	416	\$121.20	7	\$109.30
2009	24	\$74.00	1	\$29.00	351	\$114.50	13	\$152.30

2010	30	\$106.00	1	\$658.00	521	\$118.80	68	\$111.90
2011	25	\$245.00	2	\$72.00	488	\$142.60	51	\$209.60

Note. The data in columns 2, 3, 4, and 5 are from Canada's Venture Capital Market in 2011, In *Thomson Financial*, 2013, Retrieved January 29, 2013 from <http://www.canadavc.com>. The data in columns 6, 7, 8, and 9 are from Venture Backed Exits, In *National Venture Capital Association*, 2013, Retrieved January 29, 2013 from <http://www.nvca.org>.

3. Literature Review

This literature review is divided into three sections: the first discusses systems of innovation; the second discusses SMEs and innovation; and the final section examines literature on innovation intermediaries.

3.1 Systems of Innovation

Theoretical and empirical research on systems of innovation (SI) has been well-documented in existing literature. A general definition is provided by Edquist and it states that “all important economic, social, political, organizational, institutional and other factors that influence the development, diffusion, and use of innovations...included in this general definition are the relationships among the factors listed and the actions of both firms and governments” (2006, p.183). Mainstream studies have explored the SI approach from three perspectives which may be clustered under the generic systems of innovation concept and these are national, regional/local and sectoral.

Lundvall (1993) and Nelson (1993) have developed and discussed the concept of national systems of innovation which studies national boundaries, non-firms organizations and institutions; Cooke et al. (1997) have developed and discussed the concept of regional/local innovation systems that explore regions; Malerba (2002) has developed and discussed sectoral systems of innovation and production focusing on knowledge base, technologies, inputs and demands.

Furthermore, there are other specifications of SI than the national, regional/local, and sectoral levels. Carlsson and Stankiewicz (1991) have discussed the concept of technological systems which focuses mainly on networking of agents for the generation, diffusion and utilization of technologies. Also, Etzkowitz and Leydesdorff (2001) have discussed the concept of the ‘triple helix’ which focuses on the relationship between university, industry and government.

Although each of the SI concepts described above is particular to a given context, some major common themes can be observed. Firstly, the overarching goal of these concepts is to strive for economic development, whether it is at the sectoral, regional/local, or national level. This is also in line with motivation for this study, which examines certain aspects of Canada's innovation performance. Secondly, several of the stated SI concepts show how collaboration and interlinkages amongst different organizations contribute to the innovation process. To understand how collaboration and interlinkage contribute to the innovation process, it is important to first recognize a SI's components and activities.

The two main components often considered in systems of innovation literature are organizations and institutions (Edquist, 2006). Organizations are formally structured actors with an explicit purpose. Examples of organizations include firms, universities, venture capital organizations, and public agencies that are responsible for innovation policy, such as governments. Institutions, on the other hand, are common habits, norms, routines, established practices, rules, or laws that regulate the relations and interactions between individuals, groups, and organizations. Examples of institutions include patent laws, rules and norms that influence the relations between organizational actors such as universities and firms.

It should be noted that "organizations are strongly influenced and shaped by institutions, so that organizations can be said to be embedded in an institutional environment or set of rules, which include the legal system, norms, routines, standards, etc." (Edquist, 2006, p.197). At the same time, there are organizations that play important roles in creating and shaping institutions that regulate or influence other organizations. For example, governments are organizations who develop innovation policy but who also play a key role in creating the institutional environment for other organizations such as universities and firms.

Furthermore, SI's activities influence the development, diffusion, and use of innovations. According to Lundvall (1995), a central activity in a SI is learning which involves the

interaction between people, groups, and organizations. Edquist (2006) builds on this notion by emphasizing on three main kinds of learning in the SI approach, namely innovation, R&D, and competence building.

Learning through the interactive process enables transfer of knowledge and technology. Based upon the work of Bessant & Rush (1995), there are two important points to be considered regarding knowledge and technology transfer. Firstly, a transferred entity could assume a physical or intellectual form. Furthermore, it could be codified explicitly or held in tacit mode. Secondly, knowledge and technology transfer is a time-based process which involves several stages including initial recognition or opportunity or need, search, comparison, selection, acquisition, implementation, and long-term learning and development.

The need to understand the components of SI and the interlinkages between them has led to several research studies. Research and analysis on organizational actors and the interlinkages amongst them to facilitate innovation include studies on the following relationships:

- **Inter-firm collaboration:** studies reveal that firms most frequently collaborate with other firms (Bennett & Robson, 1999; Freel, 2003; Inkpen & Soroush, 2010; Lambooy, 2007). Research conducted reveals that firms collaborate with other firms to compensate for internal weaknesses and seek potential opportunities (Lee et al., 2009; Zhang & Li, 2010). Collaboration can also be a strategy for exploitative and explorative objectives (Faems et al., 2005). Exploitative-oriented collaborations tend to support improvisation exercises and further development of existing technologies and products; whereas explorative-oriented collaborations are aimed at creating new technologies and products. In general, it has been found that inter-firm collaboration has a positive relationship with innovative performance (Doloreux & Mattison, 2008; Faems et al., 2005; Human & Provan, 1997).

- **University and firm collaboration:** universities collaborate with firms in conducting research and developing innovation solutions addressing technological, economic and social issues (Acworth, 2010; Monjon & Waelbroek, 2003). An interesting finding is that small firms tend to collaborate with universities closer to the final product stage in order to deal with issues regarding their own technologies; while large firms put more focus on basic and fundamental research to diversify into newer applications when collaborating with universities (Motohashi, 2005). Work done with university and collaboration also signify the role of university technology transfer offices as important intermediaries in the transfer of knowledge and technologies (Debackere & Veugelers, 2005; Siegel et al., 2003). Another important element which is relevant in this context is that universities are also the most important source for human capital and talent for firms (Etzkowitz & Leydesdorff, 2001).
- **University and venture capital collaboration:** universities look to collaborate with venture capital organizations to support their R & D activities and also invest in potential spin-offs (Di Gregorio & Shane, 2003; Wright et al., 2006).
- **Government and venture capital collaboration:** Governments have developed policy and programs to encourage venture capital organizations to invest in start-ups and small businesses (Wright et al., 2006). Examples of such programs include: guarantee schemes that provide insurance schemes to venture capital money in case of bankruptcy; public/private equity funds through which governments and private sector co-invest on start-ups and small firms; fiscal incentives such as tax reduction on value added or income tax reduction.
- **Government, university and firm collaboration:** Along with public welfare, social security and environment, governments also have the responsibility to address the needs of firms and universities towards innovation for economic prosperity (Rothwell & Zegveld, 1981). As such, governments develop and implement programs and policies to support the innovative activities of firms and universities throughout the innovation process such as public funding, research assistance through research institutes, tax credits, and business development services (Bennett & Robson, 1999; Etzkowitz and Leydesdorff, 2001; Expert

Panel, 2006). Governments also play roles of encouraging and setting up interorganizational associations such as industry associations (Expert Panel, 2006) and research consortiums (Sakakibara & Branstetter, 2003).

Another organizational actor in the system of innovation that has been recognized in some of the recent works is non-profit organizations (Aldrich & Sasaki, 1995; Dalziel, 2006; Grindley et al., 1994; Howells, 2006; Human & Provan, 1997).

Non-profit organizations include the following:

- **Industry associations:** Organizations that operate in a specific industry for the benefit of member firms within that industry (Dalziel, 2006; Howells, 2006). Industry associations “provide access to information, promotional opportunities, lobby governments for policies that suit their members’ interests, and facilitate networking” (Dalziel, 2006: 7).
- **R & D Consortiums:** These are interorganizational arrangements utilizing joint and/or member facilities to pursue basic and applied research (Aldrich & Sasaki, 1995; Grindley et al., 1994). These consortiums may include direct “competitors pooling their resources” (Aldrich & Sasaki, 1995, p.302).
- **Science Parks:** The purpose of science parks is to stimulate the formation and development of new technology-based firms (Shearmer & Doloreux, 2000; Siegel, Westhead & Wright, 2003). Although there is not a universally accepted definition for science parks, it is generally understood that “such parks gather producers of high-technology products and services, and provide the opportunity for a degree of institutional cooperation between university and industry” (Shearmer & Doloreux, 2000, p.1066)

In general, research and analysis on these organizational actors and the interlinkages between them signify the importance of collaboration and how they contribute to or facilitate the innovation process.

Furthermore, research conducted on institutions demonstrates how environmental rules, laws and regulations can instigate healthy competition and stimulate innovation (Porter & Linde, 1995). Although firms may believe that rules, laws and regulation act as constraints to operation and limit their productivity, properly crafted institutions can in fact provide net benefits to firms. For example, regulations can inform companies about likely resource inefficiencies and potential improvements; regulation levels the playing field for firms; and regulation creates pressure that can motivate innovation and progress. Governments and standard agencies are examples of organizations that develop institutions.

Through discussions on organizations and institutions in the SI in extant literature, a set of players have emerged who may be broadly classified as intermediaries whose role is to conduct multiple tasks within the innovation process framework. This research study will review the literature on intermediaries and their role in the innovation process. Before doing this, the literature review covers the different types of innovation. Following this, the literature review looks at SMEs and innovation to provide some background that will lead to better discussion on innovation intermediaries.

3.2 Innovation and Its Different Types

Schumpeter (1934), an instrumental figure in the study of innovation, described the concept of innovation by presenting five different cases in his book *The Theory of Economic Development*. These five cases are as follows: a new good or a new quality of the good; a new method of production; opening of a new market; a new source of supply; and a new organization of an industry.

Furthermore, Schumpeter emphasized innovation as a critical dimension of economic change. He argued that industries must continually revolutionize the economic structure

from within or, in other words, industries must continually innovate for better or more effective products and processes. Schumpeter called this the process of creative destruction and considered this essential fact about capitalism (Schumpeter, 1950, p.81).

Since Schumpeter's work, extensive research has been carried out in understanding innovation by recognizing its various kinds. Abernathy and Clarke (1985) categorized innovations according to the innovation's impact on the innovating firm's capabilities and its knowledge of technology or market. Henderson and Clark (1995) categorized innovations based on the innovation's impact on existing knowledge of core concepts and components, and the linkages between them. Tushman and Anderson (1986) categorized innovations as 'competence destroying' or 'competence enhancing' based on the innovation's impact on the innovating firm's knowledge base.

Two well recognized innovation types that have emerged from these research studies are incremental and radical innovations. These two innovation types can be differentiated on the basis of two main dimensions which are discussed as follows:

1. Internal Dimension - Knowledge and resources involved: Incremental innovations build on a firm's existing knowledge and resources, i.e. it is competence enhancing. Radical innovations require a firm to gain completely new knowledge and/or resources, i.e. it is competence destroying.
2. External Dimension - Technological changes and impact upon the market competitiveness: Incremental innovations involve conservative technological developments and this means existing products in the market remain competitive. Radical innovations involve exaggerated technological developments and this means existing products could become non-competitive or obsolete.

When considering whether an innovation is incremental or radical, it is also important to see how a firm's innovation impacts the competence, capabilities and assets of suppliers, customers and complementary innovators (Afuah & Bahram, 1995). In other words, an

incremental innovation of a firm could require radical changes from its suppliers, customers or complementary innovators.

Another important concept on innovations that was pioneered by Christensen (1997) is whether an innovation is sustaining or disruptive. The objective of sustaining innovations is to improve the performance of established products that are valued by established customers in existing and major markets. Sustaining innovations can either be incremental or radical in nature. On the other hand, disruptive innovations do not aim to improve the performance of established products or meet dimensions of performance valued highly by demanding or established customers; in fact, these innovations are inferior in terms of performance in the short-term but they offer other benefits valued by niche segment customers. However, disruptive innovations' performance advances over time once it establishes itself with its niche market. Furthermore, disruptive innovations improve sufficiently over time to start meeting the needs of more demanding or established customers, and, eventually, displace established products in the market.

3.3 SMEs and Innovation

Strategic management literature contends it is often new entrants who have the capacity to come up with radical or disruptive innovations while established or incumbent firms tend to do well in developing sustainable or incremental innovations (Christensen, 1997; Foster, 1986; Utterback, 1994). This suggests that new entrants, under favourable circumstances, have the capacity of developing innovations that break into the market, perhaps even dislodging well-established leaders. This view is supported by Conner (1988) who states that “newcomers are more likely than established firms to develop radical innovations, due to the relative flexibility and adaptability of newcomers as compared to established firms, which are wedded to specific production systems, marketing approaches, and historical ways of doing business” (p.10). However, this is far easier said than done as new ventures face numerous internal and external challenges throughout the process of innovation. To better understand these challenges, one first

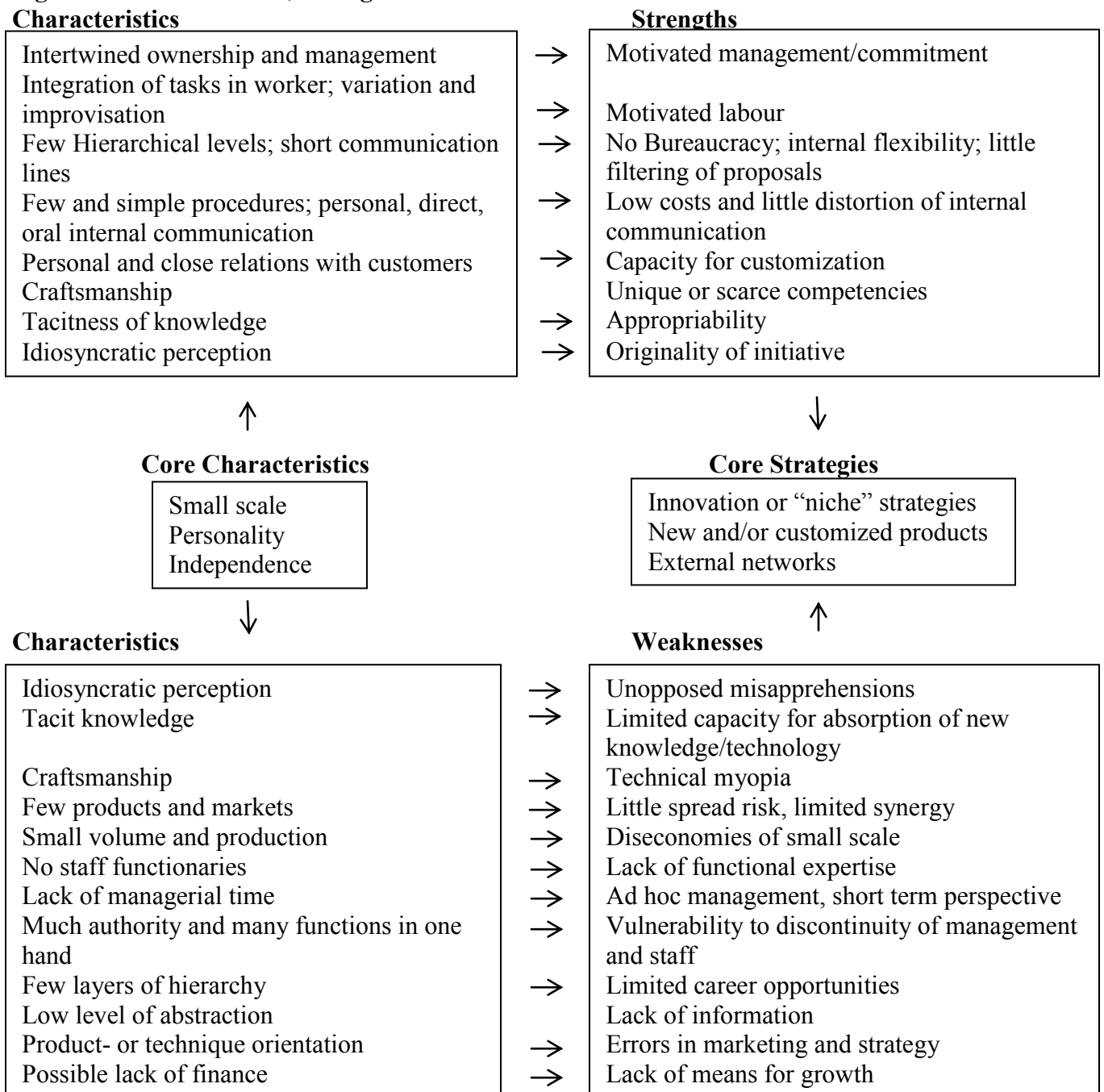
needs to recognize new ventures' characteristics from which their weaknesses can be drawn.

The core characteristics of new ventures or small firms who practice innovation can be assessed on the basis of scale, personality and independence (Nooteboom, 1994):

- **Scale:** small scale regarding production, management, marketing, and transaction costs.
- **Personality:** represents the “pervasive intertwining of private and business affairs” such as in-housing, capital, income, labour, management, internal and external contacts, and motives (Nooteboom, 1994, p.333). Along with this, there is informality of authority, communication and procedures.
- **Independence:** the relative freedom small firms experience compared to the discipline of capital markets. This freedom allows for more idiosyncratic goals and conduct.

Further characteristics, strengths and weaknesses can be derived from these core characteristics and these are summarized in Figure 2 (Nooteboom, 1994, p.334). The appropriateness of the derived characteristics, strengths, and weaknesses displayed in Figure 2 may vary from one firm to another based on a firm's capabilities, motives and goals. As firms grow from small to medium, some of their weaknesses displayed in Figure 2 decrease but some major ones are still prevalent.

Figure 2: Characteristics, Strengths & Weaknesses of Small Firms



Note. From “Innovation and Diffusion in Small Firms: Theory and Evidence,” by B. Nooteboom, B., 1994, *Small Business Economics*, 6, pp.334.

SMEs are characteristically limited by internal and external resources, especially when they first start out (Doloreux, 2004; Lee et al., 2010; Zhang & Li, 2010). In terms of internal resources, SMEs are limited by business and marketing expertise, financial resources, and human capital amongst others. In terms of external resources, SMEs have limited external relationships and technical information, and they also find difficulty accessing university expertise and government labs, and possess insufficient knowledge about R&D programs. Especially during inception, SMEs have to rely on their immediate network of limited contacts including previous working relationships, voluntary connections, and community ties.

Compounding these weaknesses and limitations is the stiff competition new ventures face from established firms. Because of their comparatively longer history, established firms have three major advantages over new ventures (Macmillan & Seldon, 2008). These are as follows:

1. Established firms have deeper insight into the various needs of the customer than any potential new venture may have.
2. Established firms have a better understanding about the profitability of serving customers.
3. Established firms' understanding and knowledge of profitability and customer needs cannot be replicated quickly, unlike product features and functions.

On top of their devotion to customers, established organizations also maintain and utilize strategic commitments to existing value networks including suppliers, investors, complementary product manufacturers and communities (Brandenburger & Nalebuff, 1997; Christensen & Rosenbloom, 1995). In comparison, SMEs have difficulty developing value networks as resource providers are hesitant or reluctant to developing relationships with SMEs that may be lacking in capital, a track record or reputation, and an objective competitive advantage (Bhide, 2000). Furthermore, resource providers find it difficult to predict which SMEs are led by entrepreneurs with the qualities and potential to raise a successful business.

The challenges discussed are magnified for SMEs, especially new ventures, in emerging industries such as cleantech (Aldrich & Fiol, 1994; Berger, 1997). Investors, suppliers, customers, and the general public have a lack of knowledge when it comes to emerging industries and, as such, are skeptical regarding the industries viability and potential. Research by Bhidé (2000) signifies the role uncertainty plays in discouraging resource providers, investors in particular, from establishing relationships with SMEs in new markets. New markets are associated with uncertainty as it can be difficult to obtain information to evaluate or measure “the risks and returns and where customer tastes and regulatory regimes, and technological discontinuities can evolve in innumerable ways” (Bhidé, 2000, p.44). On the other hand, investors require objective evidence on new initiatives to reduce uncertainty and, as such, avoid markets where they cannot obtain critical information. This is a reality SMEs have to embrace and must strategize to convince resource providers and the general public of the viability and potential of their products.

While investors are important for SMEs, they are not necessary resource providers compared to customers, employees, and suppliers amongst others for a company to generate revenue. As a result, SMEs engage in the following strategies to mitigate the challenges they face in developing their value network (Bhidé, 2000):

- **Special deals and benefits:** SMEs can provide special incentives to entice resource providers and reduce their hesitations.
- **Mimicry:** SMEs can create an external perception similar to large and well-established companies.
- **Framing:** SMEs can emphasize, even exaggerate, the value of their products to minimize resource providers’ perceived risk.
- **Broad Search:** SMEs can engage in an extensive search to find resource providers willing to take a chance with them.
- **Incremental commitments:** SMEs can propose a relationship where the level of risk increases in stage-by-stage process.
- **Second-tier resources:** SMEs can turn to second-tier resource providers when they cannot convince top-tier resource providers.

Developing a value network is essential for SMEs as collaborating with external organizations also presents them an effective strategy to compensate for internal weaknesses and challenges they face to compete in the market (Lambooy, 2007; Lee et al., 2010, Faems et al., 2005). In other words, SMEs can collaborate with external organizations to supplement or complement their internal or external activities. As such, firms have to recognize the need to collaborate with their own customers, suppliers, and even potential or existing industry competitors. Firms can also look to utilize cooperative university and government programs and facilities. The following are reasons SMEs look to collaborate with external organizations (Doloreux & Mattison, 2008; Faems et al., 2005):

1. To gain access to complementary or supplementary assets
2. To access different sources of knowledge and technology expertise
3. To stimulate transfer of codified and tacit knowledge
4. Spread costs of R&D among different parties to reduce risk
5. To access different sources of business advice

Research studies indicate SMEs collaborate with a variety of external organizations but tend to collaborate most frequently with other firms (Bennett & Robson, 1999; Freel, 2003; Inkien & Soursa, 2010; Lee et al., 2010). Moreover, investigations on interorganizational collaboration reveal a positive relationship with firms' innovative performance (Doloreux & Mattison, 2008; Faems et al., 2005; Human & Provan, 1997). Collaboration with firms, universities and research centers has various purposes; for example, SMEs may collaborate for exploitative and/or explorative objectives. Firms engage in exploitative collaborations to leverage, complement or develop existing skills, technologies and products. On the other hand, firms engage in explorative collaborations to create new competencies, technologies and products.

In this way, collaboration with external actors can assist SMEs face market competition and overcome internal weaknesses; however, there are a few main challenges in implementing this strategy. Firstly, SMEs lack external relationships and forming such

relationships, as discussed earlier, can be a challenging and time-consuming process which requires managerial capabilities, organizational resources and financial resources (Zhang & Li, 2010). Secondly, SMEs also face challenges on whom to collaborate with (Lee et al., 2010). Some relationships prove to be more fruitful than others and if relationships are not well-considered or formed effectively, then they can be a waste of time and money. Reasons for collaboration failure include unintended knowledge spillovers, learning races between the partners, diverging opinions on intended benefits, and lack of flexibility and adaptability (Faems et al., 2005). Work done by Freel (2003) supplements this view and suggests that SMEs looking to collaborate need to understand and assess that “certain types of cooperation are associated with specific types of innovation, involving certain firms, in certain sectors “(p.762).

Thirdly, when SMEs do manage to form relationships, they may be constrained by organizational capability in technology transfer (Bessant & Rush, 1995). Inexperience and the lack of managerial capabilities limit the capacity of SMEs in absorbing and assimilating new inputs of technology. Finally, SMEs face potential risk and threats that come along with cooperating with other firms (Lee et al., 2010). This in turn creates trust issues which may constrain collaboration activities with external organizations. SMEs need to feel secure regarding internal knowledge, technologies and operation procedures as these may be their competitive advantages, and studies have shown that privacy and trust issues influence who SMEs choose to collaborate with (Bennett & Robson, 1999; Doloreux & Mattison, 2008; Lee et al., 2010). SMEs may prefer collaborating with other SMEs or other institutions, such as universities and research centers, rather than with large firms because relationships with large firms limit opportunities to compete against them.

In general, the lack of internal and external resources compounds the challenges SMEs face for the development of new products or technologies and through the proceeding phases of the innovation process, including manufacturing, distribution, and successful commercialization. Collaboration with external organizations is one main strategy SMEs

can adopt to face market competition and overcome internal weaknesses; however, collaboration itself poses some major challenges for SMEs to tackle.

3.4 Innovation Intermediaries

3.4.1 The Role of Intermediaries in the Innovation Process

Innovation intermediaries have been referred to as brokers (Hargadon & Sutton, 1997) and bridgers or bridging institutions (Bessant & Rush, 1995; McEvily & Zaheer, 1999; Sapsed et al., 2007) in the innovation process. A definition which seeks to encompass some of these innovation intermediary roles is presented by Howells and it is as follows: “an organization or body that acts as an agent or broker in any aspect of the innovation process between two or more parties” (2006, p.720).

Innovation intermediaries maintain an extensive network of ties to different industries through regular interaction and this enables them to act as repositories for information, knowledge, and opportunities in the community and industry (Bessant & Rush, 1995; Dalziel, 2010; Hargadon & Sutton, 1997; Howells, 2006; McEvily & Zaheer, 1999; Zhang & Li, 2010). At the intersection of these various firms and industries, the role of intermediaries can be classified as a significant and influential one in accelerating knowledge flows and assisting firms in collaborating. In other words, innovation intermediaries facilitate knowledge and technology transfer within industries as well as across industries. The innovation intermediary role is especially an important one for SMEs that need to develop networks to compensate for limited internal and external resources and that also face challenges in creating relationships, such as the ones outlined in the last section.

Firstly, intermediaries can significantly assist SMEs with their efforts in forming external relationships as they possess information and maintain extensive networks with firms and organizations from a wide range of industry sectors. This greatly benefits SMEs who can reduce search time and money (Bessant & Rush, 1995; McEvily & Zaheer, 1999; Zhang & Li, 2010). Secondly, regarding whom to collaborate with, innovation intermediaries

utilize their extensive networks and experience to assist SMEs in recognizing which organizations would align best according to a SME's innovation and business challenges (Bessant & Rush, 1995; Inkinen & Suorsa, 2010; Lee et al., 2010).

Thirdly, in terms of organizational capability in technology transfer, innovation intermediaries can use their experience and knowledge to assist and advise SMEs to effectively compensate for lack of capabilities (Bessant & Rush, 1995; Lee et al., 2010). Lastly, intermediaries can play an important mediating role in trust creation, information networking and procedural learning which otherwise cause SMEs to constrain their collaboration efforts (Lee et. al, 2010).

In general, innovation intermediaries play an important role in broadening the external search scope of firms. This broadened external search scope contributes to the innovation process in three major ways:

1. **Information on other firms' product offerings and innovation activities:** Information regarding other firms' product offerings and innovation activities can make innovation opportunities more visible to SMEs.
2. **Increase firms' knowledge and skills:** A broadened external search scope can enrich a firm's knowledge and skills and provide more opportunities or solutions in dealing with challenges. Furthermore, a broader search scope can assist a firm's innovation efforts by adding new elements in its knowledge pool, which in turn increases new and useful combinations with these elements.
3. **Assist in creating a value network:** A broadened search scope can also help firms locate external suppliers, investors, and complementary product manufacturers which may increase firms' resources and capabilities which is crucial for the innovation process.

Points 1 and 2 can be grouped together since both facilitate innovation through information intensive activities either by helping firms understand other firms' product offerings or by enriching firms' knowledge and skills. As a result of these information intensive activities, firms can enhance their capacity throughout the innovation process.

The following sections discuss these three main ways intermediaries provide assistance to firms in the innovation process (points 1 and 2 are combined in the first section).

1) Facilitating Innovation

Since innovation is an information intensive activity, intermediary ties can significantly enable new ventures in developing their product innovations. Intermediaries can gather and provide information to firms regarding other firms' products, resources and capabilities as well as problems and solutions other firms implement during innovation (Howells, 2006; Lee et al., 2010; Zhang & Li, 2010). This information increases the likelihood of new ventures' innovation success by helping them either tackle existing challenges or helping them recognize opportunities to which to align their innovation procedures accordingly.

Moreover, in developing their innovations, SMEs engage in innovation search, which is a "problem-solving activity in which firms solve problems through combining knowledge elements to create new products" (Zhang & Li, 2010, p.88). An SME's knowledge space for innovation search consists of both internal and external sources. Internal innovation search consists of knowledge created within the SME derived from their history and the experiences of the individuals in the firm. New ventures in particular are not only limited by their short history and limited experiences, but it's also a fact that there is a limit to the number of new products that can be created using the same set of knowledge and skills. On the other hand, external innovation search is knowledge created by others which the new venture can take advantage of throughout the innovation process.

Intermediary networking can play an important role in broadening a SME's external innovation search by bringing together firms and organizations from various industries. This in turn can contribute significantly towards product innovation and/or technology convergence through accelerated knowledge flows which may also assist in overcoming challenges or present potential opportunities (Hargadon & Sutton, 1997; McEvily & Zaheer, 1999; Sapsed et al., 2007). For example, a biotechnology firm developing biochips may greatly benefit from meeting nanotechnologies experts (Lim & Park, 2009).

For the biotechnology firm, a biochip needs to be manufactured in a very small size to be inserted into a human body. Nanotechnologies expertise can provide important assistance in this regard as they are able to downsize semiconductor devices such as biochips. This illustrates how existing ideas seem new and creative when combined with other ideas to meet the needs of different users; thus, playing an important role in product innovation and design. Moreover, innovation intermediaries may be connected with several networks and this gives them the chance to recognize possible opportunities created by matching the needs of one group to the skills of another. Bessant and Rush (1995) best describe this kind of exchange of information for the creation of new ideas as “cross-pollination” (p.102). In this way, the firm’s knowledge, skills, and competencies are enhanced with the addition of new elements in the firm’s knowledge pool.

Intermediary networking activities also present knowledge spillovers from business leaders and experts from various industries which can complement the firm’s knowledge, skills, and competencies in a meaningful manner (Pennings & Harianto, 1992). This is especially beneficial for firms operating in dynamic and uncertain environments such as technology industries (Zhang & Li, 2010).

In short, from the perspective of firms, intermediary information repositories and networking opportunities can be seen as shortcut to external innovation search as it accelerates knowledge flows. SMEs with innovation challenges can seek innovation intermediary services that broaden the SMEs’ external search scope to help overcome its existing challenges, such as limited internal and external resources. At the same time, relationships with innovation intermediaries to broaden the external search scope may help an SME become more aware of opportunities that it might otherwise have not seen.

2) Value Networks

A firm’s value network includes customers, suppliers, investors, complementary product manufacturers and communities (Brandenburger & Nalebuff, 1997; Christensen & Rosenbloom, 1995). The value network of a firm is an essential part of its business strategy to compete in the market and also has significance towards developing its

innovations. In terms of business strategy, the importance of developing a value network to compete with other firms in the market is emphasized by Brandenburger and Nalebuff (1997) through the following:

Competitors play the same game... To protect your added value, you need to create relationships with your customers and suppliers. Without a relationship, you could be selling a commodity. With a relationship, you're sure to be selling something unique—part of the package is you. The relationship provides a boost to your added value. In the presence of competition, it's often the key to making money" (p.153).

Firms also have to consider their value network in developing their innovations as they have to assess how they are meeting the needs and wants of customers, suppliers, investors, and complementary product manufacturers. SMEs recognize that their competitors continually develop and utilize their value networks, and they must strategize similarly. This is especially important but difficult for new ventures and small firms who compete with established firms with well-developed value networks. In addition, the challenges new ventures and small firms confront in creating value networks is compounded in new or emerging industries associated where uncertainty discourages resources providers from participating (Bhide, 2000).

The information and networking opportunities intermediaries provide can play an important role for SMEs in recognizing important players for their value network and assist them in building important linkages. Intermediaries assist SMEs by providing them information about potential collaborators, broker transactions between two or more parties, act as a mediator (or go-between) organizations that are already collaborating, and help find advice, funding and support for the innovation outcomes of such collaborations (Howells, 2006; Inkien & Suorsa; Lee et al.; Zhang & Li). The importance of value networks is exemplified due to the fact that value networks are not static and can be highly dynamic (Brandenburger and Nalebuff, 1997; Christensen & Rosenbloom, 1995). For example, depending on the complexity of a product innovation,

manufacturer improvements of constituent components can affect the performance of upstream or downstream users and/or products within a value network. If SMEs are not able to keep up in accordance to changes within a value network then this can negatively impact their performance.

The value network SMEs can build through intermediaries' ties can also serve an important role in the diffusion and commercialization of the firm's product innovations (Inkinen & Suorsa, 2010; Lee et al., 2010). Depending on the linkages an SME can create with customers, suppliers, investors, or complementary product manufacturers, the value network can accelerate the diffusion and commercialization of a product innovation. On the other hand, not building on or creating new linkages in a value network can cost even the most established of firms as they may be displaced by competitors' products with well-established value networks of their own (Cusumano et al., 1992).

3.4.2 Innovation Intermediaries – A More Involved Role

As discussed, many studies have addressed the primary role of intermediaries as repositories for providing information scanning and gathering along with the communication function. However, recent studies signify that intermediaries have a more crucial role in increasing the innovation potential of firms than that of a broker intermediating between two or more parties (Bessant & Rush, 1995; Hargadon & Sutton, 1997; Howells, 2006; Lee et al., 2010).

Firstly, with in-depth knowledge in specialized industries, intermediaries can help firms in their product or technology development. For example, intermediaries can assist early-stage firms by emphasizing or suggesting how new or existing products can have uses and application in different and/or emerging markets (Hargadon & Sutton, 1997). Intermediaries gain this knowledge by accumulating and storing information on their interactions and activities and drawing on this knowledge to assist future clients.

Secondly, SMEs, especially new ventures that have bounded knowledge space because of their short history and limited resources, may seek help identifying what they need from potential partners or may even seek help in developing their innovation and business strategy. In response, innovation intermediaries have developed their services or functions to address these fundamental issues (Bessant & Rush, 1995).

The greater role of innovation intermediaries in providing assistance in the innovation process has been studied by Howells and he states the following:

“...intermediaries provide a much wider, more varied and holistic role for their clients in the innovation process than has generally been acknowledged. Associated with this, there is also a much wider range of innovation intermediary functions than has been usually considered” (2006, p.726).

Research by Dalziel (2010) further supports the view that intermediaries can play a broader role in the innovation and provides two other categories of services apart from networking related services: technology development related services and other activities. These two categories are discussed briefly in the following:

- **Technology development and related activities:** includes access to expertise and equipment, standards development and support for systems development, testing and validation services for new technologies and equipment, technologies’ adaptation for alternate applications, intellectual property management support services, commercialization support services, and funding for technology development activities (Dalziel, 2010, p.7).
- **Other activities:** includes providing physical space, training services, and sales and marketing advice (Dalziel, 2010, p.8).

3.4.3 Innovation Intermediary Examples

Based on the earlier discussion on systems of innovation, the following are some examples of organizational actors who fit the definition or role of an innovation intermediary:

- **Firms:** Consulting firms, technology service firms and talent search firms (Bessant & Rush, 1995; Zhang & Li, 2010).
- **Universities:** Technology transfer offices (Debackere & Veugelers, 2005; Siegel et al., 2003)
- **Governments & Non-profits:** Research Institutes, industry associations, science parks and research consortiums (Aldrich & Sasaki, 1995; Dalziel, 2006; Grindley et al., 1994; Sakakibara & Branstetter, 2003; Shearmer & Doloreux, 2000; Siegel, Westhead & Wright, 2003)

Note: Government and non-profit examples of innovation intermediaries have been grouped together as some of these organizations can be set-up by the government or stand alone as non-profits.

It has been contended whether organizations such as for-profit firms which perform intermediation activities should be included in the class of innovation intermediaries based on their rationale for existence (Dalziel, 2010). While this study does not investigate this in detail, it recognizes the difficulty of defining innovation intermediaries too broadly in order to conduct meaningful research on this class of organizations.

3.5 Summarizing Thoughts

SMEs face challenges related to internal and external resources, which comprises relationships with other organizations. These challenges are especially difficult to deal with for new ventures because of their short history and limited experiences. Because of their limited resources, SMEs may rely heavily on the success of their initial products or technologies to bring in resources, gain legitimacy, improve the likelihood of survival and develop visibility. On the flip side of the coin, failure of these initial products and technologies can further limit SMEs' resources and may result in their early demise.

Collaboration with external organizations is one main strategy SMEs can adopt to face market competition and overcome internal weaknesses; however, collaboration itself poses some major challenges for SMEs to tackle. This is especially true for SMEs in new

or emerging industries, such as cleantech, where uncertainty discourages resource providers to engage with firms. In this context, intermediaries play an important role in broadening the external search scope of SMEs, especially during their inception. According to past research and literature, intermediaries have two primary functions: scanning and gathering function, and communicating it. Although these functions provide some important benefits to SMEs, recent literature signifies a more active role of intermediaries.

The more active role of innovation intermediaries includes a range of services provided to deal with the fundamental issues of SMEs throughout the innovation process. Firstly, innovation intermediaries provide technology development and related activities to support SMEs. For example, intermediaries can assist SMEs by specifying technologies in accordance to the firm's knowledge and skills and emphasis how a firm's technologies can meet the needs of different and emergent markets. Intermediaries also provide other services such as access to physical space, training services, and business advisory services.

In this way, intermediaries can assist SMEs face challenges related to internal and external resources and enable SMEs to develop a strong foundation in the early stages of their history. This in turn may minimize the SMEs' risk and increase the likelihood of their survival and long-term success. Further research in this area will provide more evidence in this regard and may also improve the effectiveness of intermediaries' services facilitating the innovation process and how SMEs utilize these services.

In particular to the cleantech industry, it would also be interesting to investigate how intermediaries support SMEs according to the types of innovations they are introducing to the market. A study, which is particularly interesting to this research, is conducted by Sine, Haveman, and Tolbert (2005) that investigated industry association support for brown firms and green firms. Brown firms were identified as firms providing established technologies that used non-renewable fuels and green firms were identified as firms providing novel technologies that used renewable fuels. The findings of the study

indicated how industry associations provided greater support to brown firms compared to green firms. Further research on how the different innovation intermediary types support SMEs with different innovation types would provide interesting insight. This will provide information as to the effectiveness of intermediaries in supporting firms introducing different kinds of innovations.

This study attempts to increase the understanding of innovation intermediaries supporting the growth of firms from the perspective of SMEs. Specifically, it investigates the SMEs' expectations and perceptions of an established intermediary moving into their sector. In doing so, the study provides important insights into both SMEs in cleantech and innovation intermediaries (as typified by the one CBI studied), and on the way that such intermediaries can assist SMEs more effectively.

4. Methodology – Research Design

The research methodology adopted in this study is a qualitative one relying primarily on interviews. A qualitative research approach is well-suited to this study as it explores SME expectations and perceptions on innovation intermediaries. Specifically, the research study focuses on the cleantech industry and explores what expectations and perceptions cleantech SMEs have towards CBI based on their experiences with CBI. Investigating SMEs perspective on CBI is a complex procedure which involves various aspects of the SMEs, the innovation intermediary, and the industry of focus, thus, a qualitative approach is appropriate (Miles & Huberman, 1994).

The research methodology adopted in this study is designed to have both a deductive and inductive facet. Existing literature on innovation types, innovation intermediaries, and SMEs in the cleantech sector will assist in the formulation of the interview protocol. This is also where the deductive fact of the research study emerges. For example, in regards to companies' innovations, interviewees may be probed to determine if they've marketed or implemented innovations outlined in existing literature. These innovation types include the following:

- Product Innovation
- Process Innovation
- Organization Innovation
- Marketing innovation

It should also be noted that no construct is guaranteed a place in the findings and it is important to recognize that possible constructs are tentative in this type of research.

The inductive facet of this research study is basically trying to answer the following questions:

- For which challenges do cleantech SMEs seek assistance from innovation intermediaries

- What is the cleantech SMEs' perspective of CBI in assisting them overcome their challenges?

4.1 Data Sources & Collection

Purposeful sampling (Creswell, 2007; Miles & Huberman, 1994) was used to get an appropriate sample that would increase the understanding of how SMEs utilize innovation intermediary services. Purposeful sampling was important in this study to choose companies from a pool which met the following criteria:

- Is a cleantech company
- Small to medium-sized enterprise (i.e. 1-499 employees)
- Engaged with CBI and has used one or more of CBI's services

A sample of 15 SMEs was selected from the cleantech industry which have engaged with CBI. The sample SMEs were contacted to find the appropriate individual(s) to interview for data collection. Up to 2 interviews were pursued per company depending on the number of individuals representing a company in its engagements with CBI.

Selecting the sample from the same industry helped remove variation in the findings due to industrial affiliations. Companies from the selected sample were contacted through e-mail first with a brief description of the research study and request for participation. The e-mail also mentioned the required attributes in relation to the theoretical sample outlined above. When a company showed interest for participating in the research study, follow-ups were made through e-mail or over the phone to find the appropriate individual(s) to interview and to schedule a day and time to conduct the interview.

Table 12 below provides summary data on the companies that agreed to participate for this study. To ensure anonymity of participants and their organizations, as guaranteed by the terms of the ethics consent form, each company has been assigned a generic codename (company and interviewee codenames correspond by number). The table provides information on the cleantech subsectors the sample companies are from as well

as the types of innovations they are introducing or implementing in the market. The average age of the sample companies is 14 years and average size is 26 employees.

Table 12: Companies' Summary: Subsector, Age, Size, and Innovation Type(s)

Code Name	Cleantech Subsector	Founding Year	Size (no. of employees)	Innovation Type(s)
Company 1	Energy Infrastructure	2003 (10 years)	20	Incremental
Company 2	Wastewater	1989 (24 years)	12	Radical
Company 3	Recycling and waste	2005 (8 years)	145	Incremental & Radical
Company 4	Power Generation	2007 (6 years)	2	Incremental
Company 5	Biofuels and Biochemicals	2007 (6 years)	5	Radical
Company 6	Power Generation	2001 (12 years)	12	Incremental
Company 7	Biofuels and Biochemicals	2006 (7 years)	7	Incremental & Radical
Company 8	Transportation	2007 (6 years)	4	Incremental & Radical
Company 9	Water and wastewater	1985 (28 years)	19	Incremental
Company 10	Transportation	1997 (16 years)	4	Radical
Company 11	Process Efficiency and Abatement	2005 (8 years)	11	Radical
Company 12	Biofuels and Biochemicals	1974 (39 years)	120	Incremental
Company 13	Power Generation	2001 (12 years)	2	Incremental
Company 14	Power generation	2003 (10 years)	23	Incremental
Company 15	Energy Efficiency	1993 (20 years)	11	Incremental
		Average Age = 14 years approx.	Average size = 26 employees approx.	

Two main sources of data were used for this research study: primary data and secondary data. The primary data source consists of information collected through interviews. Secondary data consists of information on sample companies collected apart from the interview.

4.1.1 Primary Data - Interviews

16 interviews were conducted in total from the selected sample of 15 cleantech SMEs and were 45 to 90 minutes in length. One interview was conducted per company with 14 SMEs and two interviews were conducted with one SME. All SMEs were asked to find up to 2 individuals per company who represented the company in its interactions with CBI but only one SME, Company 2, had two individuals who were involved mainly in its interactions with CBI. It should be noted that Interviewees 2 and 16 are from Company 2.

Patton's book entitled 'Qualitative Research and Evaluation Methods' (2002) was the main source of reference used to develop the interview protocol. In his book, Patton provides variations in qualitative interviewing and the *Standardized Open-Ended Interview* format suited the research study most appropriately. The *Standardized Open-Ended Interview* format requires careful and full wording of each question before the interview (Patton, 2002). The purpose is to ensure that each interviewee is asked the same set of questions. The interview protocol had the following four main sections for questions:

- Company and Interviewee Background
- Learning about CBI and utilization of its services
- Strengths/weaknesses of CBI's services
- Wrap-up

Standard probes were also included as part of some questions. To provide an example, consider the following open-ended interview question:

Q. What services did CBI present to your company to overcome your company's innovation(s) challenges? How about assisting your company in identifying opportunities?

Based on the response to this question, the interviewee may have been probed further to explain the details of the service, the parties involved, and the time involved implementing the service. In this way, open-ended questions allowed the interviewee to report on the company's experiences without specifying details while standard probes

were used to direct the conversation to find relevant information that added value to the data collection for this research study.

The interviews were recorded, transcribed, and a contact summary form was prepared for each interview (Miles & Huberman, 1994).

4.1.2 Secondary Data

Secondary data included publicly available company information, such as companies' websites. This data was used as a source of information on the context within which the firms operate.

4.2 Data Analysis & Representation

Coding was the main method used to assist in with data analysis. As described by Miles and Huberman (1994), 'Codes are tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study' (p.56). Codes can be associated to chunks of text of varying sizes and their main purpose is to organize them. Descriptive coding and pattern coding were the two main coding procedures used for data analysis in this study. The following describes the step-by-step procedure implemented for data analysis.

(I) Descriptive Coding & Preliminary Code List: After conducting and transcribing a couple of interviews, the coding process was initiated by assigning descriptive codes to segments of text with the help of ATLAS software. As the name implies, descriptive codes is used to closely reflect and summarize segments of text with minimal interpretation (Miles & Huberman, 1994). For example, descriptive codes were assigned to the following two quotes during initial coding:

Whichever external avenues we have tried to raise funds have not been very helpful. For one reason or another it's been difficult to generate interest... It's a difficult process trying to get others to match your beliefs in the innovation... although we got

introductions to potential investors, nothing came out of it. So really, the company has not had any third party funding, it's been the management's obligation and the methods we've done include issuing equity. (Interviewee 2)

– Coded as Financial Challenges

I think really market information is what I need... access to market information that is not accessible for a small company. A lot of market information is only available if you have a lot of resources, a lot of money, you know the ability to go out and get studies... so that would be valuable to me, market information. (Interview 1)

– Coded as Marketing Challenges

A preliminary code list was then created providing descriptions for each generated descriptive code to create boundaries and distinguish one code from another. As further interviews were conducted, transcribed, and coded, the code list was revised as new codes emerged, some codes were merged, and redundant codes were removed.

(II) Pattern Coding: To reduce and channel data into a small number of concepts, pattern coding was undertaken. Pattern coding identifies themes and groups related codes under one category code (Miles & Huberman, 1994). Some pattern codes will be readily identifiable because of the interview protocol format. For example, the two descriptive codes of Financial Challenges and Marketing Challenges were put under the category code of Challenges Faced by SMEs.

(III) Analyzing Quotations: Coded quotations were retrieved and analyzed. The analysis of quotations by descriptive and pattern codes helped in developing a thorough understanding of the data. Several iterations were made to fully understand and analyze quotations under a descriptive and pattern code. Through this iterative process, significant and recurrent themes were recognized and presented in the findings.

4.3 Trustworthiness & Credibility

The following procedures were implemented in this research study to establish trustworthiness and credibility:

(I) Supervisor Reviews: Supervisor reviews entail knowledgeable and experienced researchers checking the research process of a study (Creswell, 2007). Throughout this research study, review checks were carried out with the supervisor and co-supervisor. The supervisor and co-supervisor played the role of ‘devil’s advocate’ to assess the research process and provided feedback and suggestions during the various phases of the research study.

(II) Transferability: Entails providing rich and thick descriptions in a research study so the reader can transfer conceptual components to other settings that share characteristics with the research study. Creswell (2007) supports this view through the following:

“Rich, thick description allows readers to make decisions regarding transferability because the writer describes in detail the participants or setting under study. With such detailed description, the researcher enables readers to transfer information to other settings and to determine whether the findings can be transferred because of shared characteristics” (p.209).

Throughout this research study, details of research methodology (including data collection, data sources, and data analysis & representation) and the characteristics of the cleantech SMEs interviewed are provided to help readers assess whether the findings and conclusions are relevant to other settings.

It is important to note that given the qualitative research design, this research study is not intending to generalize to a larger population. Rather, the aim of this qualitative research is to “generalize a particular set of results to some broader theory” (Yin, 1994, p.36).

5. Findings

The findings are divided into three main sections. The first section presents the findings on the challenges faced by cleantech SMEs' based on their experiences in the industry. The challenges SMEs face in the cleantech industry are what builds their expectations of innovation intermediaries, such as CBI, that aim to support the industry. In other words, SMEs expect that innovation intermediaries in their sector understand the challenges they face and, as such, provide services designed to assist them in overcoming these challenges.

The second section presents the findings on SMEs' perceptions of CBI and its services in supporting the cleantech sector. It is important to note here that the SMEs' perceptions of CBI and its services are built from their experiences with CBI and how effective they believe CBI and its services are in assisting them overcome the challenges they face in the industry. The last section presents findings on SMEs' views of what CBI's role should be in fostering the cleantech industry.

5.1 Challenges faced by SMEs' in the Cleantech Sector

To have a full understanding of the challenges SMEs face in the cleantech sector, it is first important to recognize the nature of innovations they are striving to introduce in the marketplace. The findings indicate that cleantech SMEs are introducing both incremental and radical innovations. Furthermore, SMEs categorized their products and services as non-conventional or disruptive innovations that emphasize clean technology related benefits to the community. As such, cleantech SMEs must educate the market and prove the effectiveness of their products and services but face stiff competition from conventional products and services that are already well understood and have been widely used for several years. Moreover, these SMEs are competing with established organizations that are providing these conventional solutions in the marketplace. With

this in mind, following presents the findings the cleantech SMEs discussed in regards to the challenges they face.

5.1.1 Regulatory Challenges

One of the main challenges interviewees from cleantech SMEs discussed was how their products and services need to fall in line with standards and regulations set by regulatory bodies. Whether it is with a company's inception related products or a company's expansion related products, these firms cannot move forward without obtaining regulatory approval on their products and services first. Therefore, SMEs have to keep track of changes in these standards and regulations and modify their products and services accordingly.

Interviewee 10 spoke about how SMEs need to carefully consider how there are already proven products and procedures in place in various environmental fields. Interviewee 11 also brought up how interactions with regulatory bodies can be a costly procedure.

So in sewage treatment and water treatment and other in any type of environmental field, there's already a way to do it, there's already a way to pick up the garbage, there's already a way to treat water, etc. and those are the ways that are the conventional ways and you need approval by official bodies to get anything approved and installed... It's impossible for small companies to do very much in the City at all. (Interviewee 10)

Everybody has to interact with the utilities because they are technology, they are links to opportunities... Let's put it this way, they give us permission to connect to their grid and we have to know how they think and how they do things, they have to know how we think. So it's costing in terms of technical exchange with utilities... I mean utilities as the category of organizations, power utilities... they're a layer of bureaucracy that we have to deal with. (Interviewee 11)

Furthermore, Interviewee 6 and 14 discussed how the regulatory environment in the City can change frequently and they face challenges in keeping their products and services aligned with these changes. This challenge is magnified by the fact that cleantech SMEs' products and services can involve long design and building times. Modifying their products and services according to these frequently changing regulations can become very expensive for these firms on top of the costs already associated with initial product development and approval processes.

We operate in a very regulated environment, we look at power in the province, at various sources... whether it's solar or clean energy. There are more and more players, the regulations and environment is getting more and more complex... If you look at the very beginning, one of the biggest challenges was figuring out what the new roles were and from a regulatory point of view because we are part of a hydro group of companies and we have to be very careful of what we can do and cannot do, there's only specific businesses we can be in and it's got to be related to energy... We couldn't be running a restaurant chain as an example... The generation obviously if you look at generating plants, whether it's solar, biomass or hydro, there are very long turnaround times, very long build and design times, very expensive... Our big challenges going forward... a lot of them have more to do with policy, regulations than anything else. This electrical industry is really moving and moving quickly and it's very unstable as we speak, a lot of upwards pressure on rates, a lot of issues, I'll call them opportunities around customer service. (Interviewee 6)

They make or break this industry, they start and stop this industry, they turn it on and give you a bunch of regulations and 6 months later they change the regulations, there's no notice and that becomes destructive to business plans because then they do it again 6 months later and it's bureaucrats coming up with regulations because they have a concern about something and they make a sharp and sudden change to the regulatory environment which devastates confidence in the idea of putting investment into this province, devastates business plans and tells people to un-hire staff that they've hired. The history of renewable energy in this province is stop and start, stop and start, don't make any long term plans and never believe in government's intentions. So it is, you live and you breathe that. Why can't I work in an industry where people say, okay here are the rules

and the rules are going to last 10 years, they don't even last 6 months in this province...
I'm talking about the regulatory agencies. (Interviewee 14)

As SMEs strive to grow their businesses, one area where they might look to extend or expand their services is to go international. For international growth, SMEs have to carefully consider and understand the various environmental factors of countries they are seeking to expand their services to, such as the market, economy, and regulations. This is essential for cleantech SMEs as compared to others as meeting international standards and regulations can pose significant challenges to entering international markets. Interviewee 2 spoke about how Company 2 is investigating opportunities in China but, in order to do so, the company must continue towards developing a comprehensive understanding of China's regulatory framework.

China is a market which we don't get too much success with and which we fully comprehend the path to success... what are the policy drivers, what are the economic drivers, what are the regulatory framework items of concern to the parties, living in and operating in China. In the context of City 4, there were a number of parties responsible for construction, and one of them for operation of environmental programs for water and wastewater... it began and continued to help build our understanding of the market, and we're still doing that, we're not yet in that market, whereas others are relatively more easily understood and then entered. China is a tough one (Interviewee 2).

In this way, cleantech SMEs face regulatory challenges to commercializing their products and services. This can be especially challenging considering that these firms' products are non-conventional or disruptive and are competing directly with well-understood and widely-used products provided by established organizations. Moreover, these SMEs must keep track of changing standards and regulations both to existing products and to new products they may be looking to develop; keeping up with these standards and regulatory changes can also have expensive and time consuming implications. Regulatory bodies also have bureaucratic procedures in place which can interfere with cleantech SMEs' innovation process which is discussed in the following section.

5.1.2 Bureaucratic Challenges

Another main challenge interviewees brought up was the bureaucracy involved in obtaining approval from regulatory bodies. These regulatory bodies are in charge of rules and regulations related to cleantech products and services. Interviewees brought up how the procedure of obtaining approval from these regulatory bodies can be a tediously long procedure and very costly in some instances. The time and costs associated with obtaining these approvals is a major challenge for cleantech SMEs and their long-term survival.

The combination of time and costs associated with bureaucracy create significant challenges for SMEs as they have to wait out the period of getting approval, which in turn plays a restricting factor in their growth. Interviewees 8 and 9 spoke about how it can take years to get approval for projects in the City compared to places like in the United States. Interviewee 9 also shared a case how it would cost Company 9 up to \$50,000 to get certification for a project.

We have a project here in the Province, it took 3 years to get environmental approval for that... and we had a very simple project in City 3, United States... it took 3 months to get the same approval there... So, you can see how it is. (Interviewee 8)

The product is approved by the Ministry of Environment in the States and it is a good product, there are no side effects or harm to the environment. This approved for saving fuel, this is good for cars, good for any equipment using gas or diesel. I contacted Regulatory Body 1 for selling this product, to save fuel, to save environment, to reduce carbon dioxide. They refused to accept any certificate outside of Canada... I contacted the lab from the Ministry of Environment in Canada for analysis but they couldn't help me to do this experiment and get the certification... they gave me name of a person and lab in City 2 to help me with the experiment for the product. So I contacted them but I found they ask for at least \$50,000 to make certificate... Also, they said they need time, we have to wait at least 1 or 2 years for this job. There is a big risk, I have certificate for that product but we can't sell it easily in Canada. (Interviewee 9)

Interviewee 8 also shared an experience where Company 8 was able to significantly reduce the costs of gaining approval for a couple of projects by going public. Interviewee 8 decided to publish an article in a newspaper reporting Company 8's experiences with the bureaucracy they had to deal with and was able to reduce the price tag from a million dollars for project approvals to significantly lower numbers.

It takes time, it takes forever to get something from them and then there are outrageous, outrageous challenges. An example is we had a project from where we applied for reconnection and they came back with an estimate of over a million dollars and then we didn't think that was very funny, so we wrote an article in City 2 Newspaper, it got published there and after that the reconnection came down to \$60,000... A similar event, again a connection cost us over a million dollars but the project was in the riding of one of the ministers and so after meeting with the minister, the connection came down to \$200,000. (Interviewee 8)

Interviewee 14's story is perhaps the most compelling. Company 14 had applied for approval for 3 projects from power utility organizations in 2006. While the company got approval for one of the projects fairly quickly, it took them about one year to get the approval for the other 2 projects in 2007. Unfortunately, Company 14 was bought out when its share prices dropped significantly during that year mainly due to how long it had to wait to get the approval for the 2 projects from the power utility organizations.

Company 14 was the victim of success, we were a small company and we were very successful in developing small projects and then we bid on a total of 3 projects, one for Province 2, one for Province 3 and one for Province 4. We got the Province 4 one right away... and the Province 2 and the Province 3 power utilities they received our submissions in November 2006... and they announced that our company had won both of those tenders in November of 2007. So for the whole of 2006, we could not go to our shareholders with any announcement of success, we could only say our tender submission is in and we're waiting and we couldn't raise any capital because if you don't have good news, nobody wants to hear your story. So we ended up being watched by some large companies who knew we had a huge portfolio of land out west and they

wanted that land. So they waited and waited and waited until we had no money and then they came in and they bought all the shares and they bought them for 30 cents when they'd been trading for \$2.50 and then 3 or 4 weeks after they bought the company, those two utilities announced that Company 14 had been awarded those tenders. So why did it take them 12 months to make a decision and how do you feel about losing your company because it took it took them 12 months to make a decision... So they got those... that was a huge amount of money or huge amount of production, they got them for free! So the tendency of bureaucrats to waste time, I find it intolerable. It's economically destructive. (Interviewee 14)

As observed, cleantech SMEs face long and costly approval procedures on their projects due to the bureaucracy of regulatory bodies. These bureaucratic challenges can demotivate SME executives as it slows down their companies' growth and test their financial stability over the long run. Furthermore, the bureaucratic challenges the SMEs have to endure discourage venture capitalists from investing in them and discourage potential partners who understand the cost and time it takes SMEs to gain approval on cleantech projects. The next section discusses the partnership challenges that cleantech SMEs face.

5.1.3 Partnership Challenges

Interviewees also discussed how their firms find it difficult to form partnerships. Whether it's a partnership to conduct research and development or a partnership to implement a demonstration project, cleantech SMEs have to convince potential partners of the value their product innovations can bring to the market. This is especially difficult when you consider the impact regulatory and bureaucracy challenges have in the long term for these SMEs.

The fact that we're dealing with a disruptive technology... it's going beyond what people think... We can't get certified. You can't just put product 11 on a truck and get certified

to go into the City. We have to partner with people and partnering with people just creates a nightmare. (Interviewee 11)

We currently have federal funding as well but the project's not proceeding as usual, it's a lack of partnerships with provinces. They don't seem to really get the concept of engaging in research and development in specifically the wind sector but there are other issues, other sectors where provinces really do not really (indistinct), they're not the greatest place for making new technologies. (Interviewee 14)

We actually had a \$2 million grant from SDTC and we still couldn't get the thing to fly and now I understand that our partners... the engineers, the designers, they've got something like a \$3.1 million capital grant from the clean energy fund and we're still having challenges finding a home for the project... We never got to draw the funding down because the conditions were never right. So we couldn't spend the money, the money's available if you get to the point where you've got a project and we couldn't. We went all across the country looking in different provinces for a place where we could get a combination of a reasonable power purchase agreement and a partner that wanted to own Product 11... it just never worked. (Interviewee 12)

As seen in the cases of Interviewees 12 and 14, it's especially discouraging and demotivating when for cleantech executives when their companies are unable to utilize the funding they have secured for their projects due to the fact that they were unable to find an appropriate and willing partner.

As SMEs grow, so do their partnership challenges as the risks get higher along with the return. In such cases, it's important for a cleantech SME to negotiate appropriate long-term contracts with partners. Interviewee 6 discusses how forming partnerships continues to be part of Company 6's sales challenges.

We're trying to grow a business, so we're trying to bring new products... So challenges, sales challenges is about finding the right product packaging, the right partners, that doesn't change, that's still there. On the generation side, we are looking at expanding our generating capacity, so again the right products, the right partners, the right financial

arrangements. The numbers, the expectations are getting higher, so the stakes are higher, the numbers are bigger, the risk is higher. (Interviewee 6)

Partnerships can play an important role in assisting cleantech SMEs during the various phases of the innovation process, whether it is to overcome specific challenges or if it's to create potential opportunities. However, as discussed by the interviewees, SMEs find it difficult to form partnerships because of the challenges associated with cleantech products. Therefore, these firms have to put forth extra efforts in convincing potential partners of their firm's value and how the partnerships can be mutually beneficial. This usually translates into additional expenditure in terms of time and money while understanding the risk that these potential partners may still not settle on a contractual agreement. Another strategy cleantech SMEs adopt in convincing potential partners as well as regulatory bodies and customers of their products legitimacy and value are demonstrations. However, these are also difficult to implement and this is discussed in more detail in the next section.

5.1.4 Demonstration Challenges

Cleantech SMEs use product demonstrations as a strategy to educate customers and potential partners on their products and their effectiveness. These demonstrations can be critical for these SMEs for the commercialization of their products, which are non-conventional and, as a result, are met with hesitancy in the market.

However, some interviewees brought up how it can be a challenge to get opportunities to demonstrate the abilities of their product innovations. Interviewee 14 spoke about how Company 14 had significant challenges with setting up a demonstration project for their product innovation design.

It's never gone beyond design. We haven't got it to prototype because the issue is that we can't find a power contract... So that's an interesting and delicate situation, we have to find an owner who is willing to have the prototype device and they then have to apply for

a contract for the product 14 and successfully achieve a contract and then take the whole project through environmental assessment. And everywhere we've gone in Canada for this type of thing, it's been met with a lack of interest because people would just rather take a proven, sure thing. (Interviewee 14)

Interviewee 11 spoke about how obtaining a demonstration certification could have played a major role in accelerating the acceptance of the company's product which they categorized as a disruptive innovation. However, Company 11 was asked to conduct multiple demonstration tests for the certification which were too expensive for the start-up company. In the end, Company 11 decided against it and chose to distribute the products themselves and relied on the word-of-mouth approach knowing that this approach would take them greater time to get product acceptance in the market.

It was the whole concept, we were disrupting everybody's thought and they just threw us away ... What we tell people, instead of spending tens of thousands of dollars to do a certification... at first we gave them away... so we would give them the product, they would put them on and give us feedback and then they would talk to their friends who would talk to their friends and that's how we built up our sales... People who put us on started seeing benefits and just word of mouth, and it's just built up over the years. Other than that, we would have spent a lot of money testing when we already knew the answer and we decided that, let's just go for the long haul. (Interviewee 11)

Cleantech SMEs understand the strengths and opportunities a successful demonstration can bring in terms of increasing their products' awareness; however, these demonstrations can be costly and especially challenging for firms that are just starting out. Demonstrations can assist these firms towards convincing regulatory bodies, potential partners, and customers of their products and services, but it can also mean taking the risk of a heavy investment in organizing and executing such an event. The next section looks closely at how financing is a main challenge for these SMEs.

5.1.5 Financial Challenges

Financing is a well-known challenge for SMEs both during their inception and through its early years as it looks to achieve sustainability and expand through commercialization. According to the interviewees, cleantech SMEs have major challenges in generating interest amongst venture capitalists and the financial community. The challenge of generating interest amongst the financial community can be explained by the fact that cleantech is a developing sector which has yet to show its potential. Moreover, the fact that cleantech SMEs may require a longer time to show significant returns considering how long it can take to overcome regulatory and bureaucratic challenges may discourage potential investors.

Interviewees 2 and 15 spoke about how cleantech SMEs find it difficult to raise funds and generate interest within the financing community which makes the process of commercialization difficult to achieve.

Whichever external avenues we have tried to raise funds have not been very helpful. For one reason or another it's been difficult to generate interest... It's a difficult process trying to get others to match your beliefs in the innovation... although we got introductions to potential investors, nothing came out of it. So really, the company has not had any third party funding, it's been the management's obligation and the methods we've done include issuing equity. (Interviewee 2)

There is zero venture capital money being deployed, so it sucks, it's either small or few and far between. So small businesses, start-ups, a lot of them just don't make it. They may have had good ideas and they can't find dollars or a way to successful commercialization. So, it's a case of problem by problem, innovation cannot reach it's potential, I mean it's only valid if it reaches successful commercialization and so, solar commercialization sector is scary. (Interviewee 15)

SMEs who are able to overcome early-stage financing challenges continue to face challenges to raise funds as they have to continually look to produce and develop

products and services, both to meet changing regulatory standards and to remain competitive in the industry. Interviewee 6 spoke about how raising funds is a continuing challenge as they look to expand their different product lines.

We're looking at more investments in solar, we're looking for more investments in hydroelectric power... It's how do you finance, how do you put a financial package together to buy large and extensive, whether it's a hydro plant or solar farm. (Interviewee 6)

The cleantech industry is an evolving and maturing industry which has yet to realize its potential. As such, the cleantech SMEs have more challenges attracting financial interest as compared to companies within established industries or companies in industries which demonstrate with rapid potential growth and not facing regulatory and bureaucratic barriers. This is a challenge which cleantech entrepreneurs realize when starting their companies. Interviewee 15 explains the financial challenges cleantech SMEs face as compared to companies within the software and telecommunication industries.

For software and telecom, the soft industries, so legal firms that were around, the insurance firms that were around, the banks that were around, they all jumped in when there's a new industry and it was building, they're always there to help with the funding for networking events, bringing in locals to trade shows, they were bringing in people from outside, the communities to help provide information and business stories, it came from effort and dollars and all of those surrounding industries are always the ones to do it. If there's no money in the industry, then people don't bother as much... So it's in a difficult spot from that point of view and then there's not a lot to go out there for a start-up, there is a real shortage of money and the traditional guys that would normally bring money and volunteer efforts to the table are, they don't see it, cleantech. (Interviewee 15)

As with partnerships in general, cleantech SMEs find it difficult to generate interest from the financial community. Investors are aware of the regulatory, bureaucratic and partnership challenges these SMEs have to deal with and this discourages investors. It should also be noted that investing in cleantech products presents a risky proposition

considering there are firms in other industries investors can choose to engage with. The next section discusses the last of the main challenges cleantech SMEs confront, i.e. marketing and sales challenges.

5.1.6 Marketing & Sales Challenges

Marketing and sales are well-known challenges for successful commercialization and this is no different for cleantech SMEs. In regards to marketing challenges, obtaining up-to-date market information is essential for developing effective marketing strategies for the successful commercialization of SMEs' products and services. However, gathering market information in a maturing sector such as cleantech can be difficult to obtain.

Interviewees talked about how it was important for them to gain market information for their companies in particular to their subsector within the cleantech sector. This information enables them to package and promote their products and services accordingly; however, this information is not easily accessible and can be costly to gather.

I think really market information is what I need... access to market information that is not accessible for a small company. A lot of market information is only available if you have a lot of resources, a lot of money, you know the ability to go out and get studies... so that would be valuable to me, market information. (Interview 1)

We're looking for market readiness programs that allow us to look at some of the costs involved with market size, and the cost associated with bringing the product to market. So that is the kind of information we need to have on hand. (Interviewee 5)

Furthermore, the actual process of selling their products and services poses a significant challenge to cleantech SMEs. As mentioned before, these SMEs have non-conventional products, disruptive technologies and this makes customers hesitate to accept such

products. The SMEs then face the challenge of finding customers who are willing to listen and take the time to understand their products. Even then, potential customers may still not buy these products and these SMEs have to embrace the fact that they have to continue to engage in such interactions until they prove their products in the market. Interviewee 11 spoke about experiences in getting the attention of potential customers and facing the task of convincing these customers about the value Company 11's products can deliver.

The biggest challenge is selling... getting somebody willing to listen and work with this and knows how to do testing. There are a few companies that do it but when it gets to their corporate people they back out because if you can imagine, product 11 is a disruptive technology... when you walk into a company and you're selling one of these things that they normally buy, you're ahead of the game... there is a budget for it... But when we walk in, you don't only have to sell them on the fact they need Product 11, there's no budget assigned to it which they can put it against... So there's an extra challenge, I believe it's our biggest challenge, trying to convince companies that we will change their operating budget and they should look at it that way and try and implement by buying a small package and as they see their results then they'll buy bigger packages. But then again it takes a lot of time to get it on their books. (Interviewee 11)

Interviewee 11 also shared an engagement with a potential buyer demonstrating how it can be difficult to get people to understand cleantech product innovations.

I met him at another show but I guess he was too busy doing things but he just didn't catch and that's the problem we're having with disruptive technology, it didn't catch in his head that this stuff actually worked. So with my training and knowledge of where we are, it's just cold when somebody just looks at you like a deer in headlights, you just go next, that was the case with him. (Interviewee 11)

Some interviewees also discussed how they had sales challenges in creating and agreeing on contracts with their customers. Long-term contracts can be difficult to settle in particular as potential changes with standards and regulations in the marketplace have to

be considered and addressed to the liking of all parties involved. As discussed in the regulatory challenges section, the potential for changes in the cleantech sector is a very realistic scenario. Interviewee 6 discussed sales challenges and how they continue to be a challenge as they move forward.

It's one thing to generate electricity but then you've got to be able to sell it and you've got to be able to have the right contracts in place, the right agreements, long term agreements... We had to commercialize that... that was a challenge in the beginning and it's always a challenge because the rules change the market, that's ongoing. So that was the generation side, I mean if you look at Company 6... we were out there finding the right markets to try and increase our market share. (Interviewee 6)

In general, sales and marketing capabilities are crucial to a company's successful commercialization, both in the short and long-term. This is certainly the case with cleantech SMEs; in fact, sales and marketing challenges for these SMEs are compounded due to the previously listed challenges in the cleantech sector. Commercializing products which face regulatory and bureaucratic challenges is a testing process and, furthermore, cleantech SMEs by nature introduce non-conventional innovations to the market. Given this scenario, having the necessary information and expertise to develop and implement the best marketing and sales strategy can often prove the difference between success and failure.

5.2 SMEs' Perceptions of CBI and Its Services

Cleantech SMEs engage with intermediaries to meet and connect with players from within the industry and outside the industry. This is a main strategy they adopt to find methods or potential opportunities to overcoming their challenges, discussed in detail in the previous section. This is also a primary reason why these SMEs chose to engage with CBI and use its services. Furthermore, these SMEs were drawn to CBI because of its past history and credentials as an intermediary supporting the high-tech sector and the optimism that CBI could be as effective for the cleantech sector. This section presents the findings on cleantech SMEs perceptions of CBI's performance in supporting the cleantech sector. The presented SMEs' perceptions of CBI and its services are built from their experiences with CBI and how effective they believe CBI and its services are in assisting them overcome their challenges, which were discussed in the previous section.

5.2.1 Perceptions of CBI's Events

A main service CBI organizes and provides to support cleantech companies are events on clean technology industry topics and trends and various business development aspects. Along with industry updates, information exchange and education, these events are designed largely to provide networking opportunities amongst cleantech industry players.

Interviewees stated their main objectives in attending CBI's events were to have the opportunity to meet other clean players in the industry. Interviewees 6 and 10 said that attending these events provided them an avenue to explore potential partnerships or gather insight on how other companies deal with their challenges which may in turn assist them in facing their own challenges. Interviewee 10 also discussed how companies can get tied up in their realm of work and it can be difficult to find time and arrange meetings with other players in the industry. In such circumstances, SMEs welcome opportunities to network via CBI's events.

I may connect with some good organizations, good partners, good vendors, good solutions that I would not necessarily do otherwise... These events can bring some players from the energy field and the green energy side together to share issues, to share problems, to share solutions and opportunities. (Interviewee 6)

From a theoretical or conceptual point of view, these events or these opportunities to meet people in a similar industry are very important because this is how you learn what's going on and make contacts with people that eventually might become partners in other things and there are not many of these opportunities. We're all sort of working in our own spheres and it's not often that they overlap but you need to... it's hard to dedicate time and so you have something that's worth their while. (Interviewee 10)

Interviewees also said that CBI's events gave them opportunities to educate businesses attendees inside and outside the industry about cleantech companies and products. Interviewee 15 said that his objectives to attending CBI's events included speaking and educating audiences about Company 15's subsector and products. This is also enabled Interviewee 15 to promote his company and its products.

The event's an obvious opportunity to, number one, to help educate some of the people to what they could have been doing with other stuff; and number two, if they were so, if they were to choose the new stuff that was solar then they would at least know one company, us, to include and consider in their decision making. These were not sales pitches, they were literally seminars on educating on how to go about providing for solar power within their business, installation and such. (Interviewee 15)

While the interviewees spoke about the networking opportunities CBI's events presented, they also revealed some significant shortcomings of CBI's events. To begin with, the interviewees by and large experienced that the CBI's event did not attract the expected audience of cleantech players from various sectors of the industry. Interviewees 7 and 15 spoke about how the events comprised of small and repeat audiences which was not a good representation of the cleantech industry. They also felt that the industry and

business development information CBI presented at these events did not advance their knowledge significantly.

It has anywhere from 50 to 100 people at any of these sessions and I don't think they are particularly effective to tell you the truth. I think there are lots of people that can provide updates on financial issues and marketing issues and sales issues, all of that stuff, I know plenty of people in the education business... When these things are hosted, it's the same people that go to each of these meetings... The amount of resources that go into organizing all of these things, I just don't think that CBI should be in that business. I don't think there's any real benefit to it... I don't think there's anything particularly unique that CBI brings to these events. They're professional looking events but they're pretty small and I just think they're best left for somebody else to do. (Interviewee 16)

We engaged in seminars on two different occasions. The take back from that was minimal at best, they were small sessions, and I don't think they were particularly well publicized and the people who showed up were not as much interested in the topic. I think half the people there were looking for jobs, and so I would say a lot of the other networking opportunities particularly in CBI tend to attract people who are either looking for a job or they're trying to become or are a consulting business and this is a way for them to find clientele. (Interviewee 15)

Interviewees 6 and 16 found that the CBI events attendances comprised largely of high-tech sector players and not enough from the cleantech sector. Besides attendance issues, Interviewee 7 said it was particularly difficult explaining the value of Company 7's innovations compared to high-tech products which he felt were more easily understood and thus given value. Interviewee 7 explained how his company provides process innovations which aim to improve energy efficiency in existing facilities.

I think CBI is an economic development organization and economic development to me is a very wide, it encompasses many different markets. I don't think that's it's exclusive to the high-tech sector but I hope anyway that there is a green component in there. So yeah, as far as my experience with them, it's as if when I was either at a CBI event or I

was not at the right place because there was more of the high-tech exclusiveness and we were just there as guests but I never really felt a part of it. (Interviewee 6)

This is part of the problem I see with CBI... our product is our service. We are an engineering firm not a manufacturer. So when I go to CBI meetings and I've been to a few, I find myself surrounded mostly by sales people with high-tech equipment... The outreach that CBI is doing, I find it more about gadgets and gadgets... there's not much sex appeal in these days in the world of facilities about making things work better, sex appeal is in the stuff, in the toys, make it faster, make it better... but yet buildings are burning 10, 20, 30 more percent [energy] than they have to. (Interviewee 7)

Interviewee 15 also spoke about how he was invited as a guest speaker at CBI's events but felt uncomfortable on realizing that some of the people to whom they were giving business advice were in fact looking to compete with Company 15.

So basically the time and effort to help people with their business all of a sudden turned into an opportunity for people to try and get into a consulting business, it's like we're giving them free training... There were start-up businesses that actually wanted to get into businesses to compete with us. So they were there for free consulting and so, none of them were there, the audience was not who they were supposed to be, that was very disappointing, that was not the makeup of the audience and we did it twice, and neither time was it that much better. (Interviewee 15)

Interviewees also revealed how CBI did not generate significant interest amongst the financial community to attend their events. Moreover, Interviewee 2 mentioned how it was hard to generate interest amongst the small number of potential investors who attended.

It has an attendance problem in terms of there are a lot of finance professionals in the City and a very small section come out to these events. Why is that? (Interviewee 16)

I would say that I went to these events...some of the attendees can be seen as potential venture partners or possible investors. However, although we had brief conversations

with such organizations... nothing much came from them and they were not deep conversations (interviewee 2).

Looking into reasons behind the attendance issues, Interviewees speculated that the CBI's events may not have been well-publicized and that was why they did not attract great interest amongst cleantech players and the financial community. They also believe that the information on the industry and business development CBI presents does not advance the knowledge of the attendees. Considering there are various events held by different organizations, cleantech SMEs have to select which events will bring them value with time being a limiting factor. As such, Interviewees said they did not continue attending as many CBI events because of the shortcomings they experienced.

Time is a big thing, there are only so many hours in a day and you got to make lots of networking opportunities, I mean there are lots of tons of different places you could go, meet or attend luncheons, dinners, breakfasts, it's non-stop. We get invitations, I could be at a luncheon or a meeting every day but we got to run businesses, serve our customers. So you become very selective because if not, then you're not in control of your destiny anymore. So it's a very competitive world out there in terms of the partners and with whom you want to spend your time and where you're going to build your relationships, are we better at the Chamber of Commerce or are we better at CBI or are we better at professional associations. So there's so many different ways you can get out there in the community and I would suggest it's a very competitive business and CBI has got to operate as such. (Interviewee 6)

There's a million different sessions you could go to, you could spend your whole week going to different information sessions run by the KPMGs, PWCs and Deloitte's of the world and all of that stuff. We have to be very selective of what you're presenting. I don't think CBI's events really stand out from the crowd, there's nothing that special about them that you can't find in other good events elsewhere. (Interviewee 16)

Generally, the interviewees feel that CBI events do not attract a good mix of cleantech industry players whom they can engage with and thus do not gain much value that comes in the form of networking, education and information exchange. Furthermore,

interviewees believe that the industry and business development information CBI presents at their events does not provide SMEs significant value in understanding their industry challenges or finding solutions. As a result, SMEs do not attend as many CBI events after these experiences. CBI thus has the challenge of organizing events which bring in relevant cleantech industry players including small companies, established companies and venture capitalists amongst others.

5.2.2 Perceptions of CBI's Connections

Cleantech SMEs interact with intermediaries as a main way to connect with other players in their sector for various reasons including investigating potential partnerships, generating investment introductions, and seeking opportunities for product demonstration. The interviewees observed that although CBI provides them with networking opportunities through events, there is still much CBI can do in terms of connecting them or introducing them to relevant players in the industry.

Interviewees stated that a main incentive for them to engage with CBI was to dip into CBI's knowledge of industry players to help them with potential and relevant leads. However, interviewees felt that although CBI had some knowledge of other cleantech players and supporting associations, they did not have strong relationships established with these organizations.

Why would I bother working with you if you don't have the knowledge or access to the knowledge that would be beneficial... If CBI is not going to deliver or have those programs then it needs to have much stronger relationships to organizations that do have those programs... For instance they would have no idea who the president of the Canadian Renewal Fuels Association is. They would have no clue about which are the environmental programs we can access in our local geography. They would send us to somebody who would then send us to somebody who would then send us to somebody.
(Interviewee 5)

In particular to research and development, Interviewee 5 said that CBI did not maintain or build strong connections with the research community such as universities. Interviewee 5 felt that this was an area where CBI had fallen behind especially considering their previous history in the high-tech sector. Interviewee 2 also commented that it would be useful if CBI had connections with research communities.

Other areas that they have fallen down in are the interaction with the research community. They've been traditionally a very high focus, had a great focus when they started in terms of interactions with the universities and the interactions between the universities and the companies and spin-offs and those types of things and I think that that area has been neglected in the, particularly over the last 2 or 3 years. (Interviewee 5)

I think that one [thing] they may or may not do, but [something] that might be useful to [help them] become effective is [to act as an] interface to bring companies to universities for research and evolution of their patent portfolio. (Interviewee 2)

Interviewee 14 brought up a couple of interesting examples of relevant companies existing in the cleantech industry that are somewhat hidden and were not visible to him or his competitors until recently. According to him, CBI can play an important role of having knowledge and relations with such companies and matching them with relevant players in the cleantech market space.

Let's put it this way, to some degree they have not been as successful as they might have been. I can give you an example, there's a company that manufactures solar technology that is a little leading edge at this point but nobody in my industry has really heard from them and I know that there are four of five competitors of mine in the City and I haven't heard that they're talking to that company at all. So here's a situation where right inside our backyard there's somebody who's developing stuff that might be relevant to our industry in several years and yet nobody connects with them and that to me is what CBI should be doing, is figuring out who needs what. It may be doing it with other sectors but certainly in the solar deployment, I haven't heard CBI doing very much... I'll give you another example. We're moving into LED lighting to be installed in corporate

environments and there, I believe there's a company in the City that's manufacturing some pretty out there new lighting that's LED-based and meant for commercial environments and yet I'm bombarded with Chinese manufacturers every day. I'm buying equipment from China directly, it seems to me that somebody in the City would be bombarding me with their stuff but oh no, that doesn't happen. (Interviewee 14)

Interviewees also suggested that CBI did not have strong or influential connections to the financial community or regulatory bodies to support the cleantech industry. Interviewee 8 mentioned how his challenges lie with financing and dealing with bureaucratic procedures and this is where he is looking to intermediaries like CBI for assistance.

For me it comes down to what CBI can offer in the industry it's trying to service and from my point of view it's financial leverage and really political leverage and the leverage on the bureaucracy, to move something there. And I would think they are in a better position than a small company at least, like mine, so if they want to facilitate the small and medium sized companies, I think that is where they can provide some significant contribution. (Interviewee 8)

For these cleantech SMEs, CBI is not top of mind when it comes to having strong connections with relevant players in the cleantech industry. The interviewees believe that CBI has a significant job to do when it comes to building and strengthening its connections with the cleantech community and various relevant players for the cleantech industry. Furthermore, CBI needs to demonstrate that it can be a key player for these companies in connecting and matching cleantech companies and other relevant players.

5.2.3 Perceptions of CBI's Industry Knowledge and Business Development Expertise

Industry knowledge and business development knowledge are two key ingredients essential for an intermediary like CBI to have credibility in assisting SMEs overcome

their challenges and presenting them opportunities for sustainability and growth. Industry knowledge and business development knowledge is best acquired through firsthand experiences. Having individuals who have lived, survived, and prospered in an industry enables an intermediary to have an-depth understanding of the challenges to an SME as a business as well as a player in that particular industry.

According to the interviewees, CBI is lacking in the key areas of industry and business development knowledge and this is a negative on its credibility in the cleantech sector. Interviewee 5 pointed out that, although CBI decided to start serving the cleantech sector, the intermediary seems to have insufficient knowledge of the cleantech sector to back its goals and objectives of supporting the industry. Interviewee 11 supported this view and said that CBI's staff are well-intentioned but lack the industry knowledge that really matters.

One of the issues related to CBI is that they don't have the position of the main knowledge insight... That's very much one of the issues that was in place. Whether you were a software company or an electronics company, there's a lot of knowledge in this community around those technology areas but a bio-tech company is not one of those and a clean technology company may or may not be one of those and so it's really difficult, understandably, to have that domain expertise in-house but you need have sufficient expertise in-house to interact in a credible way with the companies you are looking to serve. (Interviewee 5)

The staff, they are well-connected, they're helpful. They listen to you, they show a real interest and that's very important but it's the breadth of information that they lack is what's really needed. (Interviewee 11)

Interviewees observed that there may have been a lack of in-depth analysis done by CBI to have relevant and up-to-date information on hand to serve cleantech SMEs.

I think perhaps more proactive analysis of opportunities in other markets in a way that aligns with my industry requirements, which are perhaps a bit off the beaten track from

what CBI has looked at in the past. I mean, this has always been a very telecommunications oriented city whereas my requirements are more along the lines of smart created electricity. (Interview 1)

I found at times that there was not as much deep analysis about how many companies, do we have the venture, enough venture capital in this community, are there gaps that are missing. I mean those are things that CBI needs to spearhead continually, understanding the gaps and I haven't seen that... They should be more focused on our domain, they should be more specialized, they should have programs that fit our context, they should have programs that fit our needs more. But again, CBI is not in the cleantech game as an intermediary, they try to service the cleantech sector using fundamentally non-specific resources. They haven't developed programs specifically for clean technology in the City. (Interviewee 5)

Interviewee 5 also stated how perhaps CBI has focused too much on organizing events, whereas it should develop better services to assist SMEs with their business development challenges.

In the past, I think that CBI relied too much on events as primary, it launched events, it focused too much on events and not enough on working with companies or groups of companies to advance their businesses and I don't know if that has changed but this is what I think about it thus far... They were focused too much on events for the sake of doing an event as opposed to the event is about furthering the development of the sector. (Interviewee 5)

Furthermore, interviewees noted that many of CBI's professionals either did not have business backgrounds or business experience in the cleantech industry; rather, a few interviewees observed that CBI's professionals had more public sector experience than private sector.

If you're just coming from government work then you have no value to a private business, almost no value. A couple of guys were ex-entrepreneurs and it was a bit more useful talking to them because they had real business experience but some of them at

work are, knowledge wise, pretty useless to a private business... If you look at it, ultimately CBI is paid for by successful businesses to help unsuccessful businesses with people who haven't run businesses, so in that there is a contradiction. Furthermore, successful business didn't have to pay for CBI services and their business hasn't been anything like ours and CBI hasn't done much apart from saying they have these services. (Interviewee 12)

I think that's because it was an organization created by people outside of the industry and it's trying to bend in such a way that they can represent the industry but maybe that's why they haven't found the recipe that is successful. If this were an organization I was really keen on and was very supportive of, positive about and things like that it would be very easy for me to answer these questions with a clear understanding of what they do, with a clear understanding of what their benefits... I got the feeling that it said okay, high-tech is over, cleantech is the next big thing, lets jump on that bandwagon. (Interviewee 10)

It just seems to me that the people they put in the store didn't know about business anyways. It was a weak offering, let's put it that way... They had an office... which was a resource center for people who wanted to start businesses and it's where you could go, you could have a business plan reviewed, they wouldn't write it, they would help you write it, there was the hope that we could spawn small business and it would turn into something bigger and better and grow and etc., etc. So there was a desire to educate people as to how to become business people... It was interesting, it was well intentioned, they were running the show but it was kind of the blind leading the blind... Because they clearly hadn't got much business expertise, the people who were involved in it were not from private sector, they were from government and they were trying to teach people how to be in the private sector which was kind of ironic. They were folks without a lot of private sector experience. (Interviewee 14)

As can be observed, interviewees were discouraged to engage with CBI because of its lack of professionals with firsthand business and industry knowledge. The interviewees felt that, although well-intentioned, it's hard to value or trust CBI's programs and services because they are designed and provided by people who are lacking a

comprehensive understanding of the industry's challenges.

I don't really seek assistance from organizations like CBI anymore. I've been disappointed for a number of reasons because they have people inside them who are professional association people who don't even understand their own industry. So it's difficult to trust that resources that are made available through organizations like CBI are valuable. So measuring the utility of spending time with CBI is generally dissatisfying.
(Interviewee 14)

Overall, interviewees feel that CBI has not presented a strong image as a cleantech intermediary with a comprehensive and demonstrated understanding of the industry and business development. CBI thus faces a difficult challenge of proving its credentials as a cleantech player intermediary. In order to do so, CBI may have to take steps to gain the necessary knowledge and experience to be more effective as well as being perceived relevant and important by cleantech SMEs.

5.2.4 Perceptions of CBI's Services

For an intermediary to design and implement meaningful services to support SMEs in a sector, it must conduct extensive research to understand the sector and its various facets. However, another main observation interviewees had from their engagements with CBI was that its services are too generic and not designed effectively or targeted for the cleantech sector.

Interviewees explained how CBI was previously an intermediary in the high-tech sector and decided to serve the cleantech sector without developing a comprehensive understanding of the differences between the high-tech and cleantech sector. Because of this, CBI's services may have not been adjusted its services effectively to suit cleantech SMEs needs and support their growth. As a result, interviewees believe that CBI's services are too general to be beneficial or valuable for cleantech SMEs.

Actually, CBI really was a telecom supporter, and now, as I see it, I feel they are trying to have some valid reason to exist for all businesses in the City but this is where they are losing credibility because they neither have the expertise or experience to provide significant assistance to businesses from all industries. (Interviewee 2)

The weakness of their philosophy was that one size fits all and unfortunately one size does not fit all and we are not all software companies... Yes they would be perceived more valuable if they are more focused on our domain, they are more specialized, they have programs that fit our context, they have programs that fit our needs more. But again, CBI is not in the cleantech game as a focused intermediary, they try to service the cleantech sector using fundamentally non-specific resources. They haven't developed programs specifically for clean technology in the City. So, if they're not so then I have to go outside to do that and if they say well I can connect you to somebody else, well I already have my connections... They are using generic resources or generic programming to try to support companies when companies need their specific programming in different sectors and then because they don't have the domain knowledge, they're not as highly beneficial to a company like us. (Interviewee 5)

Interviewees believe CBI providing generic services and not developing comprehensive knowledge of their industry makes it a less credible organization. Interviewee 14 reasoned that CBI should make it clear which sector its services are intended for in order to avoid being judged on sectors they do not support.

They don't want to be measured on the sectors they didn't treat, say if they have a business plan that says they're not going to deal with the solar energy industry then that's fine, I can accept that. But say they have a business plan that says we're going to deal with everybody all the time then I worry about their mission with their limited resources and I worry maybe that there isn't very much that's going to get done and probably why their phone hasn't rung too often over the last 10 years. (Interviewee 14)

Interviewee 4 discussed how there are several domains within the cleantech industry and suggests CBI should look to focus on only 3 or 4 of these domains. Choosing to serve a few domains within the cleantech space may enable CBI to become more focused in

providing specialized and targeted services. Even though this entails serving a smaller subset of the cleantech sector, CBI will at least be perceived as relevant and important towards this subset.

I think it would be preferable if CBI would look at the strengths of the City's companies instead of potential for innovation in the cleantech universe. Think of 3 or 4 domains that we have intrinsic competitive advantages or potential competitive advantage and focus on those, I would argue that clean energy is one... So I think it would be better if rather than being sort of a broad support group for cleantech then CBI was focused on 3 or 4 domains within the cleantech sector... Within cleantech you can deal with clean air, you can deal with water, you can deal with agricultural products, you can deal with health products, you can deal with energy, those are broad based domains and so there's a lack of focus. I mean there are opportunities in the cleantech but if you're going to go or say we are going to work on cleantech but in that CBI lacks credibility. Tell me the two or three domains you're focused on and where you have intrinsic competitive advantage and technology solutions and innovation capacities, then I'd pay more attention and so I think CBI should focus (Interviewee 4).

The interviewees do not find CBI's services useful or significant in helping them meet their sector based challenges because the services are generic in nature. SMEs as a category have some general challenges such as financing, sales, and marketing; however, these challenges vary from SMEs of one industry to another and, moreover, SMEs also have challenges particular to their sector. This is the case with the cleantech industry where challenges such as regulatory, bureaucracy, demonstration and partnership play a bigger role compared to other industries and can be difficult to overcome.

5.2.5 Promotion of CBI and Its Services

An important aspect that enables an intermediary like CBI to make contributions to supporting a sector is its ability to inform various relevant players about itself. Therefore, CBI's marketing and promotion strategy becomes crucial to informing cleantech players about CBI's objectives and services to supporting the industry. The more informed

cleantech SMEs are about CBI's objectives and services for the industry, the more likely these SMEs are to engage with CBI and use its services.

According to the interviewees, CBI has not done an effective job of informing cleantech SMEs about its objectives and services for the industry. This is despite the fact that these interviewees have engaged with CBI and used its services. This in turn has resulted in a lack of awareness amongst cleantech SMEs of how CBI can play a role in supporting them and the sector. Although interviewees recognized this may have been partly their fault, they said that the onus was on CBI to demonstrate their relevancy to the industry through good web services and outreach.

I think it's awareness... being aware what the programs are and how they help people. I mean it's a two-way street, you also have to go looking for these programs but clearly that has been an obstacle for companies. I think that's the primary one – just awareness of what they have and how can they help. If we don't know how they can help then I'm not going to spend much time doing it. (Interviewee 5)

I think there's a lot of people in the community that feel very much like I do that they really don't know what CBI is about... I've been in business in the City my whole life in a lot of jobs that had varied amount of profile associated with them and I don't know what CBI really does and what it stands for and what its mandate is. That's a problem, I should know that and I don't and it may be doing a lot of good things but I don't know about it. (Interviewee 16)

I don't really know what they can do for the industry... I don't know what they have, what kind of tools they have at their disposal. If it's just that they have some money to pay for their salaries but really have no tools for anything then it's going to be very difficult for them to do anything. (Interviewee 8)

Interviewees also mentioned that the shortcomings they observed at CBI's events may have discouraged them from further investigating how CBI could assist them in overcoming their challenges or presenting opportunities.

What we were in it for were abilities where we could have and where we would volunteer our time and effort to do that, to help educate people, in the small business area in the City, so we spoke at events and if those seminars were bigger and well attended, I think everybody would benefit from that but the fact is they aren't... I'm not sure what other services they have or offer... Maybe there are services that they have to offer and we're not aware of them but that's a possibility. (Interviewee 15)

In the case of Interviewee 2, his company actually benefitted from CBI's international program. However, despite this positive experience, he has not found reasons to further utilize CBI's services because he was unaware of CBI's range of services that could benefit his company.

The one instance that I felt really where they were highly valuable was organizing an international marriage mission. And we were able to participate because it was well organized and gave us compelling value to participate. If I haven't participated in other things that they have done which is obviously the case, I would say the issue has been I've been unaware of compelling reasons to participate or the value it would deliver... You can't get on doing it if you don't know what it's about. I think they've probably been doing things that I didn't expect they were doing or didn't know they were doing. (Interviewee 2)

Based on the interviewees' comments, it is clear that CBI has a selling job to do on two fronts. Firstly, CBI has to improve the awareness of its objectives and services for the cleantech sector through web services and other avenues of outreach. Secondly, CBI has to showcase the role it can play and the role it has played for cleantech SMEs to attract interest from within and outside the sector.

That means you have to have very good web services, you have to have outreach to the companies. It's essentially a matter of outreach because that's what you need to have... If you're not outreaching to the companies that you already know, there's very little you can expect. (Interviewee 5)

I think one of the things that CBI needs is again get some wind, what are they doing for the business community, what are they doing in terms of investments, what are they doing to serve the existing business such as ours. It's not clear in my mind what they can do for us right now... Maybe I was not aware of what CBI can do for us but if I'm looking overall, CBI for Company 6 has not been a big business partner and maybe that can change in the future... If I'm looking at awareness level as a member, they are not top of mind when it comes time to call for a partner, to call for help, to call for solutions... I think CBI has a selling job to do... You've got a website and all that but I'm not sure that I totally or that Company 6 totally understands what CBI can do for us or what does CBI expect from us. (Interviewee 6)

Overall, CBI has to recognize that cleantech SMEs are not fully aware of CBI's objectives and services for the sector. The lack of awareness of CBI and its services may be a limiting factor in its contribution and efforts for the cleantech industry. Once this is recognized, CBI has to strategize and implement a marketing strategy that will improve the organizations awareness and the role it can play for moving the cleantech industry forward.

5.2.6 Summary: SMEs Perceptions of CBI and Its Services

Cleantech SMEs have developed three common perceptions of CBI that discourage them to engage or develop an ongoing relationship with CBI. These perceptions have been built based on cleantech SMEs' experiences with and knowledge relating to CBI. These perceptions can be segmented into three main categories:

1. SMEs perceive CBI as a start-up company specialist
2. SMEs perceive CBI as experts in the high-tech sector
3. SMEs do not perceive CBI as a strong cleantech intermediary based on their experiences with CBI.

The perception that CBI is best suited to support start-up companies is based upon the SMEs experiences at CBI's events and with its services. Firstly, interviewees believe that

CBI's services are designed for SMEs in general. As a result, cleantech SMEs believe that the generic nature of CBI's services is only suitable and limited to start-up companies who face early-stage challenges. Interviewees stated that although they might be small companies in terms of size, they have overcome the start-up phase and are facing challenges towards achieving further growth.

CBI can't do anything for me, I'm not a new player, the domain is specific... I mean they're helpful and so people think it's nice to be helpful... but really I think it's going to be a very rare company who benefits significantly through them with the exception of the ones that are in the innovation incubation stage or go through the incubator. So I think the incubator would kind of be the more substantial thing I would talk about for CBI right now, it's going to be for new companies and start-ups by and large. (Interviewee 4)

I didn't think they would really help with what we're doing. We're well beyond from being a start-up, we've been in this mode now for 12 years and that's not a start-up. (Interviewee 14)

Interviewees' experiences at CBI's events also played a role in developing the perception that CBI is best suited for start-up companies mainly. Interviewee 6 shared how he developed this perception of CBI after he observed that large portions of attendees at CBI events were start-up companies.

I see CBI, and maybe it's just my perception, as more of a tool for start-up companies, for people wanting to move here from other cities, other countries, other provinces, well that's where I think CBI can really play a role... I think there is some benefit in keeping a good and steady relationship with them but if you ask me one issue or one solution that I would need CBI for right now, I can't think of it... When I was at their events a couple of years ago, if I looked at who was in the room, it was high-tech start-up companies. It was very strong from that point of view because I remember the number of emails I got the day after requesting more meetings and you know, I'm a young entrepreneur and just starting up a company. So certainly it was very high-tech in very start-up companies. (Interviewee 6)

As observed, Interviewee 6 also found that the majority of the event participants were from the high-tech sector and this leads to the second common perception that CBI is best suited to support the high-tech sector. Interviewees said that CBI's events attracted more attendees from the high-tech sector and not enough from the cleantech sector. Such experiences combined with interviewees' knowledge of CBI's history as an intermediary that supported the high-tech sector has developed this second common perception.

It may be perception more than reality but CBI to me was always very focused on high-tech and I think that maybe this has been to their disadvantage at one point because it's CBI, its high-tech... that whole cluster and traditional organizations that may have felt that they were welcomed or that there was a lot in it for them is around that CBI... and I was just checking the website this morning and I look at some of the things that are now mentioned in key sectors, you've got the clean but you've got life sciences, aerospace, government, you've got wireless and I think... first of all, be very clear is it high-tech only and if it isn't, make that very clear... I think CBI is an economic development organization and economic development to me is very wide, it encompasses many different markets. (Interviewee 6)

The perception that CBI is better suited for the high-tech sector is magnified due to the fact that CBI has not done an effective job of spreading its awareness as a cleantech intermediary or demonstrating its credentials as a cleantech intermediary. The marketing and promotion job CBI has to execute more effectively was discussed earlier as well.

I think that from my perception of CBI, from being on the outside, it was, when it started, it had this aura of being sort of a prestigious organization, this pride, and to be this and that, it was a big deal and after engaging with them, it does not have any of that same kind of aura about it... when the tech bubble burst, the organization seemed to really become very quiet and there wasn't very much that I heard and maybe that was because different people I knew weren't working in the industry any longer or for some reason and then four, five years ago I heard that they were trying to create a cleantech focus and reinvent themselves with the new name because it isn't really a research initiative, it's a networking thing at best... I got the feeling that it said, okay high-tech is over, cleantech is the next big thing, let's jump on that bandwagon... They were trying to create more

relevance for themselves and it's hard to do that. So that's my perception of the start, they were sort of a prestigious organization and a couple of people talked to me, you should come out to these things, these are really great events and then for some years there was nothing. (Interviewee 10)

CBI's failure to support and demonstrate its credentials as a cleantech intermediary leads to the third common perception of CBI. Interviewees explained how CBI has not built a strong perception of a cleantech intermediary based on their experiences with CBI's events and services as well the lack of connections and knowledge it has demonstrated on the industry. At first, cleantech SMEs were drawn to CBI as an intermediary which could help them in dealing with challenges or seek opportunities. However, for reasons mentioned, these SMEs formed poor impressions of CBI when their engagements with the intermediary did not prove very beneficial for the SMEs and left a lot to be desired.

My perception of CBI is not particularly positive, it's one that there's a large organization spread too thin, it doesn't really have a clear mandate of what it is trying to accomplish, trying to be everything to everybody and not doing particularly effective job of a lot of things... it may be doing a lot of good things but I don't know about it and I don't feel that I really ever got value from the membership that we bought into CBI. So I'm not sure why that is, I'm not sure if my perceptions are right or wrong or what, I just know that they're my perceptions. So I think that's the weakness that in general, the greater business community in the City, it doesn't have a good understanding of what CBI does and how it can help their business. (Interviewee 16)

I never really kept engaged at a regular level, I didn't see it doing very much and I remember when CBI created a new business services desk... and they tried to have an operation that was kind of consulting in nature that helped people start companies and I just thought, oh that's very interesting... I have no idea who flew as a result of those efforts because it just seems to me that the people they put in the store didn't know about business anyways. It was a weak offering, let's put it that way. (Interviewee 14)

Interviewee 6 also revealed how he did not perceive CBI to be a strong intermediary because of its reactive approach. He suggested that CBI has to adopt a more proactive

approach to demonstrate its value to cleantech players in order to help change its perception to a positive one.

If I look at or gaze on one to a hundred in terms of key partners, if I look at the headspace that CBI takes in my day or in my organization to say... it is not front or center, top of mind and maybe they got some work to do there to demonstrate what they can bring to an organization like Company 6. If I was commenting on the relationship with CBI, it is a very reactive organization. It's a meeting or something like that but it's never a proactive thing and I think there's a responsibility there on CBI to try and make that more of a relationship that is proactive and if I'm looking at my deck of cards for solutions, that CBI becomes part of that deck, whereas today they are not. (Interviewee 6)

In all, cleantech SMEs have disengaged with CBI because of the three common perceptions they have of the intermediary. So, although CBI may have redesigned or enhanced its services to be more effective and relevant for cleantech players, CBI will now have the added challenge of re-engaging SMEs who do not have a positive perception of them. Interviewee 2 discussed the challenge CBI has in drawing cleantech SMEs who have disengaged.

The challenge that they have.... after some time, you just assume what they're saying rather than listening to what their saying. So, CBI...may have changed but probably my expectation, perception of it hasn't because I haven't heard of CBI... My point really is that, I haven't pinned much expectation of participating with them in the last 5 years or so. The problem with that is that I haven't been attentive with what they're doing and therefore, it's almost more harm for them as an old organization where I have a perception that exists as to what they do or don't do, to get my attention again. (Interviewee 2)

Overall, these cleantech SMEs do not look to CBI when looking for assistance to confront challenges or to seek various kinds of opportunities because of the perceptions they have of CBI. As such, CBI faces a significant and important challenge of changing how SMEs perceive the intermediary from a weak player to a relevant and strong player.

5.3 CBI's Role in Fostering the Cleantech Ecosystem

Cleantech SMEs recognize the importance of an organization like CBI in the City although it has several issues to address and perceptions to overcome. The interviewees indicated that CBI has showcased its capabilities as an intermediary in the high-tech sector and believe this demonstrates its capacity to play an important role towards the growth of a sector.

Interviewee 6 said that CBI can generate interest and excitement in the cleantech industry but first it has to demonstrate its credentials and do a better job of marketing itself amongst cleantech players in the industry.

I believe in the CBI organization, I think it's required, I think it's needed, badly needed in the City and I hope they're successful. I think that CBI has to do a better job of informing their local partners and members of what exactly their all about, what they can do for us. Even maybe something like a newsletter through email which has a listing of services and maybe a few success stories, month by month. I think that's the type of stuff that creates some excitement and momentum. Yeah, that's sort of where I see it as an organization and it has a very important mandate, but I think to be successful it's going to need good local support. (Interviewee 6)

CBI also needs to improve the services it provides to support the cleantech sector. According to Interviewee 4, CBI can achieve this by either focusing its efforts by services or by focusing on only 3 or 4 domains within the cleantech industry.

I just think that overall what CBI needs to do is to get much sharper at what they can offer people and the only way you can do that is by focusing and you need to be focused either by domain and/or by specific level of service... I'm not going to say I'm going to get involved with a business association who just gives me general information and general conferences. (Interviewee 4)

In terms of services, CBI may improve and optimize its efforts by selecting a subset amongst the realm of challenges SMEs face in the cleantech industry. For example, CBI could provide services designed to support cleantech SMEs with challenges such as hiring staff, accessing markets and raising capital. In terms of domains, CBI could focus on fewer subsectors amongst the various cleantech subsectors in the region including biofuels and biochemicals, power generation, energy infrastructure, energy efficiency, process efficiency and abatement, recycling and waste, remediation, transportation, and water and waste water. In this way, focusing on selected services and subsectors may facilitate CBI's efforts to providing more specialized services for the cleantech SMEs.

Interviewees also discussed CBI's role and potential in assisting cleantech SMEs face their sector specific challenges provided that CBI revisits and re-strategizes its objectives and services. In terms of regulatory challenges, the interviewees believe that CBI can take on the important task of facilitating their interactions with regulatory bodies. They believe CBI can provide support and assistance in encouraging regulatory bodies to understand their products and services, which are non-conventional, and become more accepting.

Where they might be more relevant is if they could influence Regulatory Body 1 to be more accepting of new technologies in waste water treatment... cause we're here, we're here in the City; however, the process for approval of any projects and the built-in government infrastructure and the built-in preferences by the bureaucracy in the City, make it so that it's nearly impossible to get any non-conventional thing approved in the City. (Interviewee 10)

In my view this would be on the regulatory side... Can they go after those in charge to make changes or not... That is, I would say, 90% of the success of any small company, that are they actually allowed to sell the product or not? And normally they're not. (Interviewee 8)

Furthermore, interviewees said that the CBI has and can play a key role to alleviating bureaucratic challenges cleantech SMEs face which can be lengthy and costly to deal

with. The interviewees believe the CBI can contribute significantly towards the cleantech SMEs cause by advocating on their behalf to the regulatory bodies in trying to create solutions through programs and policies.

This is where I'm looking to CBI to help us. If they want to promote business here in the City they have to make business plans... For me it comes down to what can CBI offer in the industry it's trying to service and from my point of view it's really political leverage and the leverage on the bureaucracy, to move something there. And I would think they are in a better position than small company, at least like mine, so if they want to facilitate the small and medium sized companies, I think that's where they can provide some significant contribution. (Interviewee 14)

What we'd hope from them is to break down barriers to business, to doing more business. So we talked earlier about some of the barriers, lack of funds, lack of knowledge, lack of interest, lack of motivation related to the bureaucracy or whatever you want to call it, it's the help to breakdown some of those things, bringing information to decision makers. So if something's being blocked at a lower level then somebody at a higher level could look at the information and re-enforce certain behaviours, or certain decisions that will start to erode those obstacles that are in the way. So, I guess that's a combination of information dissemination, promotion, just creating awareness in general. (Interviewee 7)

In terms of demonstration challenges, interviewees said that CBI could be doing them a great service by playing a role in setting-up demonstrations for them. They believe that the CBI could provide either a demonstration site or assist in the demonstration process which would break down some of the barriers related to the regulatory side or getting market acceptance for their innovative products and services.

For example if there was an area designated, part of the City, in this area we're going to build and demonstrate some innovative technologies to showcase what's going on here and we're going to allow the approval process to accept these little projects... It would be a way, ideally, some way to utilize technology in a demonstration project in the city, or around near the city... This business of cleantech, it's really filled with practical practitioners, not so much theorists and so having something that appeals to practitioners

and tinkerers and that sort of thing would be more engaging to them than having another powerpoint presentation by somebody on somebody else's theory. (Interviewee 10)

We can definitely improve if they can help us negotiate... and we get a demonstration site for example that could definitely advance our speed time... I wouldn't even know whom to talk to seek this and I think CBI could know that...if they can have a demonstration on the regulatory side on behalf of companies like mine. (Interviewee 8)

In terms of financial challenges, interviewees suggested that CBI needs to figure out strategies to generate interest amongst the financial community for their industry. This may require CBI interacting with the financial community and discussing what kind of events would appeal to them or get their attention.

What I hope CBI does is figures out how to bring capital into the City because I think that's one of the big barriers right now to innovation, it's just the capital required to start some of these companies... The only way to figure that out is to go talk to the finance community and understand from them why they don't go to these events, do they know about them and what kind of events would be more appealing to them and would cause them to attend them and probably a better job at marketing and understanding of the market that they were trying to address. (Interviewee 16)

In terms of partnership challenges, interviewees believe that CBI has an important role in introducing them to potential partners and helping them bring down some of the barriers towards understanding cleantech products and services. Especially with respect to R&D, interviewees said that they would like CBI's assistance in forming relations with research institutes and universities for product development collaboration efforts.

If they had a gateway methodology to work with research institutes or universities that would be useful... We do directly on our own but it might be much easier if CBI had some advanced methods for us to do that because it's not straight forward how to do that. (Interviewee 2)

On another important note, interviewees talked about how CBI needs to carefully compare and contrast the high-tech sector with the cleantech sector. Specifically, CBI needs to recognize that the factors that made CBI relevant and resourceful in the high-tech sector may vary or may not be as effective for the cleantech sector. A close look at these sectors reveals some important differences which CBI needs to take into account. Firstly, the high-tech industry does not face as many and challenging regulatory approval procedures as compared to the cleantech sector. Secondly, there is a greater interest amongst the financial community for the high-tech sector versus the cleantech sector because of quicker turnarounds on investment generally. Thirdly, there was a good mix of small and large companies in the high-tech sector compared to the cleantech sector which comprises mainly of small players.

I think CBI, originally, was successful because the high-tech industry was a new industry that didn't involve any sort of involvement by Regulatory Body 1, official in terms of approval or acceptance or something like that. It was a group of companies that had a product that they were selling worldwide and so that model to get people to meet each other and getting the people to know who else is in the community was very effective. There was a period of rapid innovation in that technology. (Interviewee 10)

In the high-tech space... they would have interesting speakers coming in, there was a talk about start-ups, about issues they're having and not having, there were events for venture capitalist brought in together... They were mixing it up between VCs and the telecom players and the start-ups. They had good interactions between start-up companies and large established companies because the whole ecosystem was growing at pace. The challenge with the cleantech industry is we don't have an ecosystem that's bubbling over like that and people are trying to start companies from scratch... ecosystems that are just getting started because you don't get money and it's difficult to make that happen... I think there's an opportunity to become a part of a new cluster... If you and each of us are doing what we need to do to stay in business, you don't build an industry on your own... Those abilities to bring different people together to try and make things work but cleantech industry doesn't have any of the really big companies to deal with, so it's a different model, you're going to have to find a different way to network to get the smaller guys together. (Interviewee 15)

As such, CBI has to understand the environment of the cleantech industry so it can develop its services more effectively and so that it is perceived to be more relevant for cleantech players. The interviewees understand that it's not easy to support an ecosystem which is still in the development stages but, as they point out, every successful ecosystem had a start and CBI can play an integral role in developing the cleantech ecosystem in the City. Interviewees 10 and 15 spoke about how North Carolina and Waterloo, respectively, serve as good examples of how successful ecosystems are developed.

People are only going to join and participate in something that benefits them... This is a way that different areas differentiate themselves in the Research Triangle of North Carolina, they built all those universities and research areas by deciding to become a hub for high-tech and bio-tech pharma hub. Well, there was a start to that. Some people said let's try to do that and then they created the environment necessary for all that to happen and there's a lot of potential in the City to also create this kind of hub because there's a lot of work going on at the universities here and other areas and so it would take sort of marshaling the resources that were there already and then demonstrating to people, hey this is how we can help you. For example, there are grad students at University 1 looking for projects to work on and companies could participate with these people and that sort of thing but I don't think it's hopeless. (Interviewee 10)

If you go down to Waterloo, the ecosystem down there until this year was bubbling and so what you had was, you had RIM that was doing well, Open Text was doing well, Christie Digital was doing well, all these companies were doing very well and if these companies are doing well all local companies around them start to do well and the angel investors are investing in new companies and the whole area starts to grow... I think this sector of renewable, both in terms of energy generation and integration and there are other technologies that I think could be brought into the mix but if the City wants to see that ecosystem start-up, they need to find ways to get people interested and interested parties together on a regular basis. And secondly, and most importantly, in this province and this is not just for CBI but an overall problem... there needs to be investors. (Interviewee 15)

Developing a comprehensive understanding of cleantech SMEs' challenges will enable the CBI to assess the generic nature of its services they presently have in place for cleantech SMEs. Moreover, along with a better focus and more specialized services, CBI may be able to develop innovative methods to more effectively assist cleantech SMEs in overcoming their challenge and presenting opportunities for growth. If CBI can succeed in growing some SMEs into larger organizations, then this could play a significant role in generating further enthusiasm and interest on the cleantech industry.

It's not just the number of spin-offs that they've helped, it's how they've grown a climate base, delivered investment into these companies... One of the big issues related to drawing companies in the City is the maturation of companies and it's very, obviously, difficult to do that... making small company into a large company is a gap in this community that needs to be looked at and addressed and a lot of that is driven by external forces as well as the capability of the management, access to the market, those types of things. I think we need to do a better job and I think the outreach that CBI needs to do globally needs to be marketing. (Interviewee 5)

Success breeds success... I want to see CBI bring some local investments, bring us the companies, bring us some new companies in town, look at are we really successful in getting a green energy sector or a green cluster in the City. I certainly hope that CBI continues to look at and you want to see some wins and I don't know exactly what that looks like right now but we want to see some action and some results and again, those may not be the home run but you want to see some tangible things because again I think success will attract more players around and more interest in regular dealings with CBI. (Interviewee 6)

So if I have an innovation and am starting a company or working for one, is CBI a good place to go to act as a partner to help me build the company. I think that's one of the things it wants to figure out, how do you foster young companies, how do you build the infrastructure in the City to allow a company to grow... It needs to have access to capital, needs to have access to people with good ideas who would work for your company, access to markets and access to people who can help grow your company to a 1,000 person company... I don't think they should be providing grass roots education, I think

just there's too many people that do it, it's too time consuming and other people can do it better... when they bring business leaders... I love going hearing those and I think they draw really good crowds and it gives the City a good tool for enthusiasm and adrenaline in terms of it really motivates you to go and do bigger things. (Interviewee 16)

Overall, the interviewees believe that CBI has an important role to play in developing the cleantech ecosystem. In order to do so, CBI has to develop a comprehensive understanding of the challenges faced by SMEs in the cleantech industry and the present status of the cleantech environment. These challenges include alleviating regulatory and bureaucratic procedures that slow down SMEs' growth in the industry. SMEs also seek demonstration opportunities and need assistance in generating interest amongst the financial community.

6. Discussion

This study has developed a deeper understanding of innovation intermediaries and SMEs within the context of the cleantech sector. Specifically, the findings extend understanding on innovation intermediaries by showcasing how CBI, a regional economic development organization that supports companies from various sectors, is not effective in supporting cleantech companies who face specific challenges relating to their particular sector.

The following sections discuss how this understanding on innovation intermediaries is developed from the main findings of this study. Section 6.1 discusses cleantech SMEs' challenges for innovation and commercialization which are particular to their sector and for which they seek assistance from innovation intermediaries. Following this, section 6.2 discusses cleantech SMEs' perceptions of CBI based on their expectations of CBI as an intermediary and their experiences with CBI. Lastly, Section 6.3 delves into why CBI is not effective in supporting cleantech SMEs with their innovation and commercialization challenges.

6.1 SMEs' Challenges for Innovation and Commercialization

Recalling the information presented in the literature review, it is evident from the findings that SMEs in the emerging cleantech industry are introducing non-conventional or disruptive innovations in the marketplace (Christensen, 1997; Foster, 1986; Utterback, 1994). Cleantech SMEs face difficult innovation and commercialization challenges as they have to confront uncertainty associated with the emerging cleantech industry (Bhide, 2000) while introducing non-conventional solutions in cleantech fields that are still evolving and whose potential is yet to be fully recognized in the marketplace (Aldrich & Fiol, 1994; Berger, 1997). Furthermore, cleantech SMEs innovations are competing with established products in their respective energy and/or environmental fields. Displacing established products is no easy task as they are already proven and well understood by the private and public sector and are widely used as a result. In other words, these

established products have become the conventional solutions or the norm in their respective fields for several years. Moreover, these conventional solutions are being provided by established organizations that have well-developed value networks including suppliers, investors, complementary product manufacturers and communities (Brandenburger & Nalebuff, 1997; Christensen & Rosenbloom, 1995), as well as established regulatory systems. Therefore, cleantech SMEs recognize that not only are they competing with conventional solutions with their disruptive innovations but that they're also competing with established organizations that have major advantages over them (Macmillan & Seldon, 2008).

The research supports that, similar to SMEs in general, cleantech SMEs are limited by internal and external resources and seek assistance or collaborations with external organizations to assist with their internal and external activities (Faems et al., 2005; Lambooy, 2007; Lee et al., 2010). Specifically, the limited internal and external resources of cleantech SMEs create significant financial, partnership, marketing and sales challenges. It should be noted that these challenges are compounded due to the uncertainty associated with emerging markets and the SMEs' non-conventional or disruptive solutions that compete against established organizations and products. Firstly, cleantech SMEs lack funds to support their research and development activities and commercialization activities which can constrain their potential. Moreover, cleantech SMEs lack external ties to venture capitalists and find it particularly difficult to generate interest amongst the financial community. This is explained by the fact that investors do not like uncertainty associated with new markets and find it difficult to obtain objective evidence in cleantech fields that are still evolving (Bhide, 2000). In addition, investors are discouraged by the amount of time it takes for cleantech SMEs and their innovations to realize returns. Secondly, cleantech SMEs lack partnerships with external organizations to support their research and development activities. Here also they find it difficult to attract interest amongst resource providers largely due to uncertainty and the non-conventional innovations cleantech SME are looking to develop. Thirdly, cleantech SMEs lack marketing and sales information and expertise to commercialize their innovations. Like with the other challenges, cleantech SMEs' marketing and sales

challenges are compounded due to the fact that they are providing non-conventional solutions in cleantech fields which are still evolving and whose potential is still to be fully recognized in the marketplace (Aldrich & Fiol, 1994; Berger, 1997).

While cleantech SMEs face challenges similar to SMEs in general, the research showed how there are substantial challenges particular to the cleantech industry which contribute significantly to the uncertainty associated with it and constrain cleantech SMEs' performance and potential. Firstly, standards and regulations set by regulatory bodies play a decisive role for SMEs in the cleantech industry. Cleantech SMEs have to take into account how standards and regulations apply to their innovations and have to obtain regulatory approval or certification, which can be costly, before they can commercialize their innovations. SMEs must also monitor their regulatory environment which can change often and understand how it applies to their organization and products. This creates a climate of uncertainty which restrains SMEs' long-term planning and discourages investors and partnerships. Secondly, the bureaucracy related to obtaining regulatory approval or certification causes major headaches for cleantech SMEs. For example, Company 14 had to wait for about a year to get regulatory approval for one of its major projects. As a result, Company 14's share prices dropped sharply and the company was bought out by the time it received regulatory approval. In another case, Company 8 was forced to take drastic actions when regulatory bodies put a price tag of over a million dollars for one of its projects. As such, the bureaucracy related to obtaining regulatory approval or certification can test a cleantech SMEs' financial stability and long-term survival and growth. Again, this contributes to the uncertainty associated with the cleantech industry and discourages resource providers. Thirdly, demonstration opportunities are more essential to cleantech SMEs' than others as they hope to convince the viability and effectiveness of their innovations to audiences including customers, potential partners and regulatory bodies. However, arranging demonstration projects poses significant challenges for cleantech SMEs as the disruptive nature of their innovations makes it harder to generate support from the community.

The role institutions play with regards to innovation by creating environmental rules, laws and regulations has been observed in systems of innovation (Porter & Linde, 1995). Properly crafted rules, laws, and regulations are set by regulatory bodies to provide net benefits to firms as well as instigate healthy competition and stimulate innovation in an industry. In the case of the cleantech industry, the research reveals how shifting and evolving standards and regulations appear to be constraining the operations and productivity of SMEs however. Moreover, slow regulatory approval and the bureaucracy that comes with it challenge the long-term survival and growth of cleantech SMEs who already have difficult challenges to begin with.

6.2 SMEs' Perceptions of CBI and Its Services

Similar to the summarized literature on the role of intermediaries in the innovation process (Bessant & Rush, 1995; Dalziel, 2010; Hargadon & Sutton, 1997; Howells, 2006; McEvily & Zaheer, 1999; Zhang & Li, 2010), the research shows that cleantech SMEs engaged with CBI with the expectations of connecting with various cleantech and other relevant players allowing them to explore potential partnerships, investment introductions, and marketing opportunities. This would help SMEs develop their value network (Brandenburger & Nalebuff, 1997; Christensen & Rosenbloom, 1995) while reducing their search time (Bessant & Rush, 1995; McEvily & Zaheer, 1999; Zhang & Li, 2010). In congruence to more recent literature on innovation intermediaries, another main reason why cleantech SMEs engaged with CBI was to utilize its industry and business development knowledge and services (Bessant & Rush, 1995; Dalziel, 2010; Hargadon & Sutton, 1997; Howells, 2006; Lee et al., 2010). Specifically, SMEs engaged with CBI to seek assistance and find solutions to challenges they faced as players in the emerging cleantech industry.

In terms of networking opportunities, SMEs felt by and large that CBI's networking events did not bring together a large and diversified attendance of cleantech players and other relevant players from the financial, research, and other communities. As a result,

SMEs revealed that CBI did not play an influential role in introducing or connecting them to relevant and important players that could assist them in dealing with their challenges or present them opportunities towards their innovation and commercialization activities. Furthermore, SMEs indicated that there were significant shortcomings with CBI's industry and business development knowledge and services. Firstly, the SMEs said that CBI did not have a strong knowledge of the industry and the challenges SMEs faced in the industry. Secondly, SMEs said that CBI did not appear to have the necessary business development expertise in particular to cleantech companies. For example, SMEs observed that CBI's staff did not have the relevant and extensive business experience working in the cleantech industry and that they came from public sector backgrounds. Thirdly, the SMEs said that CBI's services were too general and were not specific to supporting the needs of cleantech SMEs. Because of this, the SMEs felt that CBI's services were not effective in assisting cleantech companies with their challenges and were limited to assisting start-up ventures and early-stage challenges.

In general, it appears that CBI has been unable to utilize its experience as an established intermediary for the high-tech sector effectively for supporting cleantech SMEs whether they are introducing incremental or radical innovations. Based on their experiences, these SMEs are not inclined to continue engaging with CBI and look for alternative options to finding solutions to deal with their innovation and commercialization challenges.

Research on established organizations confronting change report that the same capabilities which proved to be effective in the original environment for an organization may in fact constrain its performance in another environment (Christensen & Overdorf, 2000; Nadler & Tushman, 1989). This seems to be the case with CBI who needs to recognize that the same strategy, resources, and processes which enabled it to become an established intermediary in the high-tech sector may not be as effective or productive for meeting its objectives for the cleantech industry because of the differences between the two sectors and their markets. Moreover, CBI needs to determine whether it has the resources and processes it needs to be a relevant and important player for the cleantech industry. A major part of this analysis is to recognize that there are specific challenges and opportunities related to every sector. SMEs as a category have some general

challenges such as financing, sales, and marketing; however, these challenges vary from SMEs of one industry to another and, moreover, SMEs also have challenges particular to their sector. This is the case with the cleantech industry where challenges such as regulatory, bureaucracy, demonstration and partnership can be seen as more difficult to deal with compared to those of other industries.

6.3 Extending Understanding on Innovation Intermediaries

The research findings reveal how CBI has several shortcomings when it comes to supporting cleantech SMEs in facing their innovation and commercialization challenges in the sector. The main question that arises from these findings is why has CBI not been effective in assisting cleantech SMEs overcome their challenges. The answer to this question is best understood when we compare the objective and strategy of CBI, a regional intermediary that services several sectors, to industry associations who focus on a single sector.

To begin with, it is important to note how CBI is a nonprofit, regional intermediary whose objective is to develop and advance the business climate of City 1. To achieve this, CBI's strategy is to develop and support a large clientele base to contribute to the growth of various sectors in City 1. As mentioned earlier, CBI looks to support over 700 member companies across various industries in City 1. However, it is difficult for an organization such as CBI to acquire in-depth knowledge and experience of these various industries in order to effectively specific needs of its client companies.

As a result, CBI may be providing more effective services in sectors where it has been able to acquire sufficient knowledge and experience but ends up providing generic services to other sectors where it does not have adequate knowledge and experience. In this way, CBI ends up providing generic services to various sectors, where it lacks in-depth knowledge and experience, in attempting to meet the many needs of its diverse

members. While this may work in supporting companies from these sectors facing similar challenges, this limits CBI's effectiveness and ability to support companies who face specific challenges to their sector. This scenario is discussed by Salamon's (1995) research on the non-profit or voluntary sector and who categorizes this type of voluntary sector failure as "particularism". Voluntary sector particularism occurs when not all segments of a community are equally represented or supported by a voluntary organization. Voluntary organizations can choose to favour certain subgroups in a community, due to constraints on resources or decision makers, and this leaves some subgroups without adequate representation or support.

This is the case with the cleantech sector where CBI's services prove insufficient in assisting cleantech companies confront their sector specific challenges. From CBI's perspective, however, the cleantech sector is one of several industries that CBI has selected to support and which represents a small portion of CBI's 700+ member companies. It should also be pointed out that it was difficult to find cleantech SMEs for this study who had interacted with CBI extensively to collect meaningful data. It is possible that this is indicative of the amount of attention CBI is giving to the specific needs of cleantech SMEs.

In comparison, industry associations are better suited to provide sector specific needs as their objective is to develop and advance companies in the focal industry. Research by Dalziel (2006) illustrates how industry associations make strong contributions to innovation as "their heterogeneity mirrors the heterogeneity in the population of firms that are their clients" (p.299). As such, industry associations' strategy consist of utilizing their specialized knowledge and experience in the industry to design and provide services to effectively assist their client companies in overcoming their innovation and commercialization challenges.

The presented discussion extends understanding on innovation intermediaries by showcasing how CBI, a regional intermediary, is not effective in supporting companies from varying industries with their sector specific needs or challenges.

7. Conclusion

This section summarizes this study's contributions to literature on SMEs and innovation intermediaries. Next, the section presents this study's implications and limitations. Lastly, directions for future research are discussed.

7.1 Contributions

This study builds on extant literature on SMEs practicing innovation and on innovation intermediaries. In regards to SMEs, the study develops a deeper understanding of SMEs' challenges in innovation and commercialization within the context of the cleantech industry. Apart from well-known challenges such as financing, partnerships, marketing and sales, the study reveals the decisive influence regulatory procedures and the bureaucracy associated with it have on the survival and growth of cleantech SMEs. The study also describes how these challenges are compounded due to uncertainty associated with the emerging cleantech industry and the non-conventional or disruptive solutions cleantech SMEs are trying to bring to the market.

In regards to innovation intermediaries, the study reveals SMEs' perceptions of an established intermediary moving into their sector based on the challenges they face in the sector and their experiences with the intermediary. In doing so, the study demonstrates how the capabilities of an intermediary in supporting one sector may be ineffective or constrain its performance in supporting another sector. More importantly, the study showcases and discusses how and why CBI, a nonprofit regional intermediary, is not effective in supporting cleantech SMEs with their sector specific needs or challenges.

7.2 Implications

A main motivation behind this study was exploring the role of innovation intermediaries in assisting Canadian SMEs with their innovation and commercialization challenges, and the study puts light on some key aspects for managers of innovation intermediaries to

consider. Before deciding to support a sector, managers of intermediaries have to develop a comprehensive understanding of companies' innovation and commercialization challenges in the sector. As the findings on the cleantech companies have demonstrated, companies' challenges can vary from one industry to another and an industry sector as a whole may also have its unique challenges. Managers of established intermediaries in particular have to recognize how capabilities that made them effective in one sector may not be transferable to another sector and that adjustments may be necessary.

The study also suggests some important implications for policy makers regarding the cleantech industry. Firstly, the study indicates there is a need for governments and regulatory bodies to examine the impact that standards and regulations have on sustaining and encouraging cleantech innovations. Secondly, governments and regulatory bodies have to assess the bureaucracy that cleantech companies have to deal with when applying for regulatory approval or certification. In general, regulatory and bureaucracy challenges create barriers for cleantech companies and their innovation and commercialization efforts. Canada's evolving cleantech industry is one which promises prosperity but one which needs a conducive environment for innovation.

7.3 Limitations

It is important to highlight the limitations of my study in order to make a valid contribution to existing theories and knowledge on SMEs and innovation intermediaries. First of all, statistical generalization from the cleantech SMEs investigated to a large population is limited due to the qualitative nature of the study as well as the small, regional sample size. Secondly, the findings of this study are specific to the intermediary that was the subject of my analysis and generalizability to other settings will be constrained. Analytical generalization, however, is applicable as my study looks to generalize the particular set of results to some broader theories (Yin, 1994). In all, this study's findings are not intended for statistical generalization but to explore and build on exiting theories and knowledge on SMEs and innovation intermediaries.

This study's main research question and research design focused on CBI and did not investigate other intermediaries. It should be point out that the cleantech SMEs interviewed indicated that they approached other intermediaries, apart from CBI, in City 1 to seek support. Investigating these other intermediaries was out of the scope of this research. In addition, this research study explores SMEs' interactions with CBI from the SMEs' perspective and did not seek to investigate CBI's perspective on these interactions. Lastly, this research study had a small sample size of 15 cleantech companies. This was due to time and resource constraints along with the relatively small number of cleantech SMEs who had interacted with CBI extensively.

7.4 Future Research

My study explored the expectations and perceptions that SMEs in the emerging cleantech sector have on CBI, an established intermediary that is moving into their sector. As pointed out earlier in the limitations section, the sample SMEs indicated that they approached other intermediaries for assistance in overcoming challenges and seeking opportunities. Future research should expand into focusing on research questions and empirical approaches to explore these other intermediaries that cleantech SMEs approach for assistance. Investigating these other intermediaries would provide a basis for comparison with intermediaries such as CBI. Furthermore, future research should focus on questions that explore intermediaries' perspectives on their interactions with cleantech SMEs. Finally, future research on innovation intermediaries could be expanded in other evolving sectors in Canada.

8. References

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9. Interview Protocol

Time of Interview: _____

Date: _____

Place: _____

Interviewer: _____

Interviewee: _____

Position of interviewee: _____

Questions:

Section I: Company and Interviewee Background

1. Confirm company background
 - (Founding Year)
 - (Number of Employees)
 - (Company goals, mission)
2. Briefly, what is your individual background?
3. What innovations has your company brought to market or implemented in the cleantech area?

Section II: Questions regarding CBI and utilization of its services

4. How did you learn about CBI and based on what evaluation did your company choose to approach CBI?
5. Describe the challenges/opportunities related to your company's innovation(s) for which your company decided to approach CBI?
6. What kind of relationship did your company develop with CBI?
7. What services did CBI present to your company to overcome your company's innovation(s) challenges? How about assisting your company in identifying opportunities?
8. Did these services entail bringing other organizations to assist in overcoming your company's challenges or presenting opportunities? If so, who were these organizations and how did you collaborate?

Section III: Strengths/weaknesses of CBI's services

9. Based on your experience, what were the strengths of the services provided by CBI?

10. Were there weaknesses/inadequacies in the services provided? If so, how did you overcome these weaknesses/inadequacies?
11. Keeping in mind the discussion we've had, what were the key factors that enabled or hindered you to utilize the services provided? Give examples.
12. What criteria would you use to measure success of the services provided?
13. According to the criteria you mentioned, how successful would you say the services provided to your company were in overcoming challenges (or presenting you opportunities)?
14. Where or how do you think you could have improved in utilizing the services provided to you?
15. How could CBI improve the services provided?
16. Have you had any working experience in another sector? If so, which sector and did you deal with innovation intermediaries? And if yes, was the relationship similar or different?

Section IV: Wrap up.

17. That covers the things I wanted to ask. What should I have asked you that I didn't think to ask?

Closing Remarks:

Thank the individual for participating in the study with the interview. Assure him of her of confidentiality of responses and potential future interviews.