

Sustainable Valley Entrepreneurial Ecosystems

Boyd Cohen*
University of Victoria, Canada

ABSTRACT

This research examines the applicability of the entrepreneurial ecosystem literature to the development of a 'sustainable valley', whereby a community becomes a centre for entrepreneurial innovations. Specifically, this research explores how components of the formal and informal network, physical infrastructure and culture within a community could contribute to a sustainable entrepreneurial ecosystem. One community, Victoria, British Columbia, is utilized to lay out the framework for the infrastructure necessary to create such a system. Copyright © 2005 John Wiley & Sons, Ltd and ERP Environment.

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Introduction

WHILE A PLETHORA OF CORPORATE ENVIRONMENTAL AND SUSTAINABILITY INITIATIVES, programmes, and management systems is fuelling a growing body of scholarly literature on 'corporate greening', very little effort has been made to understand the role that young, entrepreneurial firms can contribute towards a more sustainable society through innovation (Cohen and Winn, 2003; Schaper, 2002; Schick *et al.*, 2002). This research takes an early step towards enhancing our collective knowledge about how sustainable innovations may come about. Specifically, it applies the components of an entrepreneurial ecosystem identified by Neck, Meyer, Cohen and Corbett (2004) to discuss how a community could potentially evolve into a 'sustainable valley' where a cluster of innovative sustainable technologies is developed in a geographic region.

Silicon Valley, begun in the early 1940s, is recognized throughout the world as a leading epicentre for technological innovation. While not on par with Silicon Valley, other North American communities such as Boston's Route 128, North Carolina's Research Triangle, Austin, TX, and Boulder, CO, have all had some success in stimulating economic development through technological entrepreneurship.

In recent years, discussions have begun to surface regarding the potential for the development of sustainable or living cities (Portney, 2003). Some cities, with the help of local and regional governments,

* Correspondence to: Dr. Boyd Cohen, University of Victoria, Faculty of Business, PO Box 1700 STN CSC, Victoria, BC V8W 2Y2, Canada
E-mail: bcohen@uvic.ca

have sought to foster sustainable development through industrial ecology. Industrial ecology has emerged as an interdisciplinary field to develop normative and descriptive guidance for networks of actors working together to engage in sustainable development (Korhonen, 2004). In many instances local industrial ecology efforts manifest themselves as eco-industrial parks by engaging manufacturers, customers and other actors in attempt to create closed-loop systems. Eco-industrial park development generally focuses on existing medium- to large-sized manufacturers. It may also be possible to develop clusters of innovative, entrepreneurial firms devoted to sustainable development and closed-loop systems as well.

For example, the Sustainable Valley Group (www.sustainablevalleygroup.org) has a mission to 'promote the generation and implementation of ideas to bring about a financially and environmentally sustainable economy' in Springfield, VT. They have organized 'green teams' around several components they perceive to be important in fostering a sustainable valley such as a team to examine the potential of emerging sustainable technologies, a team to explore capital access for sustainable ventures and a team to identify how political and legal structures could be changed to expedite the transition towards a sustainable economy in their community.

To date, very few cities have truly developed a competence and reputation for being centres of sustainable innovations. So, what would it take for a community to reach a level of prominence as a world leader in the development of a sustainable entrepreneurial ecosystem? This research seeks to uncover some of the most critical components necessary for the accomplishment of such an objective. This research begins with a literature review of geographic cluster development and industrial ecology. This leads into a review of the literature on entrepreneurial ecosystems. The remaining text explores the potential applicability of entrepreneurial ecosystems to the introduction of a new modified form of an eco-industrial park, referred to as a sustainable entrepreneurial ecosystem (SEE).

Geographic Clusters and Industrial Ecology

The advantages of scale economies accrued by global corporations have led many to overlook the importance of local geography in developing competitive advantage (Porter, 1998). Porter (1998) focuses on the development of industry clusters pertaining to specific industries rather than a broader cluster, which may concentrate business activity across multiple industries (e.g. as in the case of a sustainable ecosystem). In recent years, several scholars (including Porter) have begun to look at the development of industrial ecology and ecosystems (e.g. Esty and Porter, 1998; Korhonen, 2004).

Industrial ecology provides prescriptive advice in its use of 'the metaphor of sustainable natural ecosystems as a model for transforming unsustainable industrial systems' (Korhonen *et al.*, 2004, p. 290). An application of industrial ecology is the use of eco-industrial parks (Korhonen *et al.*, 2004) whereby local geographic clusters develop in attempt to create a closed loop system amongst manufacturers, consumers and other societal and economic actors (e.g. van Leeuwen *et al.*, 2003; Lambert and Boons, 2002). The current research seeks to suggest the development of a modified form of an eco-industrial park, herein referred to as sustainable entrepreneurial ecosystems.

Entrepreneurial Ecosystems

Entrepreneurial ecosystems represent a diverse set of inter-dependent actors within a geographic region that influence the formation and eventual trajectory of the entire group of actors and potentially the

economy as a whole (Spilling, 1996; Iansiti and Levien, 2004). Entrepreneurial ecosystems evolve through a set of interdependent components which interact to generate new venture creation over time (Van de Ven, 1993).

Van de Ven (1993) suggests that a historical focus by researchers on individual entrepreneurs has led to a lack of appreciation for the actions of multiple actors (private and public) that facilitate the creation of successful entrepreneurial ecosystems. The importance of the interacting of interdependent components in the entrepreneurial ecosystem cannot be overlooked (Spilling, 1996):

Economic development is a result of complex entrepreneurial processes. Many things are linked together; many ventures develop in close interaction with each other and with environmental factors. Furthermore, the development of communities requires more than just the development of a number of businesses; it is also about infrastructure, public institutions, and about firms that can match together in advanced production systems (p. 91).

Extant research has shown the importance that different, individual components of an entrepreneurial system may have in the overall macro-economic development of a region (Spilling, 1996; Prevezer, 2001; Shepherd, 1987; Florida and Kenney, 1988). A cyclical process can take place whereby other actors (e.g. venture capital firms) in the entrepreneurial ecosystem are attracted to the area, which subsequently leads to the introduction of more successful start-ups (Malecki, 1997).

Neck *et al.* (2004) were among the first to attempt to holistically examine the interaction of the multiple components of the entrepreneurial ecosystem, which collectively influence the development of technology clusters in a region. Neck *et al.* (2004) conducted semi-structured interviews, followed by qualitative analysis to identify the components of the entrepreneurial ecosystem in Boulder, CO, which led to the creation of a cluster of technology start-ups. These components included formal and informal networks, physical infrastructure and community culture.

Applying the items identified in the Neck *et al.* (2004) study to the discussion of sustainable entrepreneurial activity, this research seeks to develop an understanding of what components of the entrepreneurial ecosystem would be necessary and what role they could play in fostering an SEE in the way that Silicon Valley has become the place for technological innovation.

For the purposes of this study, sustainable entrepreneurial ecosystems are defined as an interconnected group of actors in a local geographic community committed to sustainable development through the support and facilitation of new sustainable ventures. Therefore, the objective of an SEE is to create social, environmental and economic value in a community through the development of sustainable new ventures. Benefits of an SEE could include job growth, economic growth, improved environmental conditions, improved health and a reduction of poverty and homelessness.

Each of the entrepreneurial ecosystem components are introduced and defined in traditional ways, followed by a discussion of how each component could be relevant for the creation of an SEE. Finally one community, Victoria, British Columbia, has been chosen to illustrate how these components may be represented within an SEE. Therefore, examples will be used to reflect the current progress in Victoria with respect to the identified components (summarized in Figure 1).

Table 1 identifies and describes each component of the entrepreneurial ecosystem, as identified in the Neck *et al.* (2004) study. The final column summarizes the role that each of the components could play in fostering a sustainable entrepreneurial ecosystem.

Figure 1 below visually depicts the current components of the entrepreneurial ecosystem in Victoria, British Columbia, which have the potential to lead to the evolution of an SEE. The model is individualized for Victoria and focuses on the contributing components of the system.

System component	Definition/applicability to traditional systems	Application to sustainable entrepreneurial ecosystem (SEE)
Informal network	Represents the entrepreneur's friends, families, colleagues and informal relations with similar companies (Neck <i>et al.</i> , 2004; Birley, 1985).	The same members of an informal network can assist (or hinder) an entrepreneur in pursuit of sustainable innovations. Sustainable entrepreneurs sometimes face more barriers from the formal network so the importance of the informal may be even greater.
Formal network	Is a diverse group of actors in an economic community such as a research university, government, professional and support services, capital sources, talent and large corporations (Neck <i>et al.</i> , 2004; Birley, 1985).	Members of the formal network often cause challenges for sustainable entrepreneurs due to lack of understanding/expertise in sustainability. Formal network actors are addressed individually below.
University	Research universities can have a significant impact on the evolution of an ecosystem through primary research and education of skilled workers (Bruno and Tybjee, 1982; Neck <i>et al.</i> , 2004).	Research universities can create and disseminate knowledge regarding sustainability and even developing and commercializing technologies, prior impacts of unsustainable behaviour and raising awareness in the community at large, particularly through leading by example.
Government	Federal, regional and local governments foster or hinder the development of entrepreneurial ecosystems through tax rates and incentives, subsidies and grants and eliminating the bureaucratic 'red tape' (Siegel <i>et al.</i> , 2003).	Governments can play a significant role in fostering an SEE through policies that encourage or mandate more sustainable behaviour on the part of consumers and firms. Much innovation can actually be compelled through proper policy application (e.g. mandating reduced vehicle emissions).
Professional and support services	Entrepreneurial support services include entrepreneurial tax and legal support, consultants, and firms in the supply chain (Neck <i>et al.</i> , 2004).	To support the SEE, a variety of specialty advisers who understand and value sustainability principles should be present to overcome barriers from traditional advisers who do not understand the challenges faced by these ventures (Schick <i>et al.</i> , 2002).
Capital services	Access to start-up capital such as venture capital or angel investors for new ventures is of critical importance in the development of entrepreneurial ecosystems (Prevezer, 2001; Neck <i>et al.</i> , 2004).	Sustainable ventures are also dependent upon access to start-up capital, and often have challenges finding investors who understand their businesses and share their values (Schick <i>et al.</i> , 2002). Specialized 'green investors' are needed.
Talent pool	Access to a large number of qualified employees is critical for the success of an entrepreneurial ecosystem (Neck <i>et al.</i> , 2004).	Access to qualified employees with knowledge and values relating to sustainability would be helpful. Employees looking for sustainable innovations are also necessary.

Table 1. Entrepreneurial ecosystem components applied to sustainable entrepreneurial ecosystems

Entrepreneurial Ecosystem Components in the Context of Environmental Sustainability

As the Neck *et al.* (2004) research utilized a geographic region to identify the components of the entrepreneurial ecosystem in Boulder, CO, this research identifies a particular region, Victoria, British Columbia, to discuss its potential to achieve an SEE. The development of an entrepreneurial ecosystem is restricted to geographic boundaries and is highly influenced by local geographical environments (Prevezer, 2001). While choice of location is subjective, Victoria was chosen not to isolate it as the one

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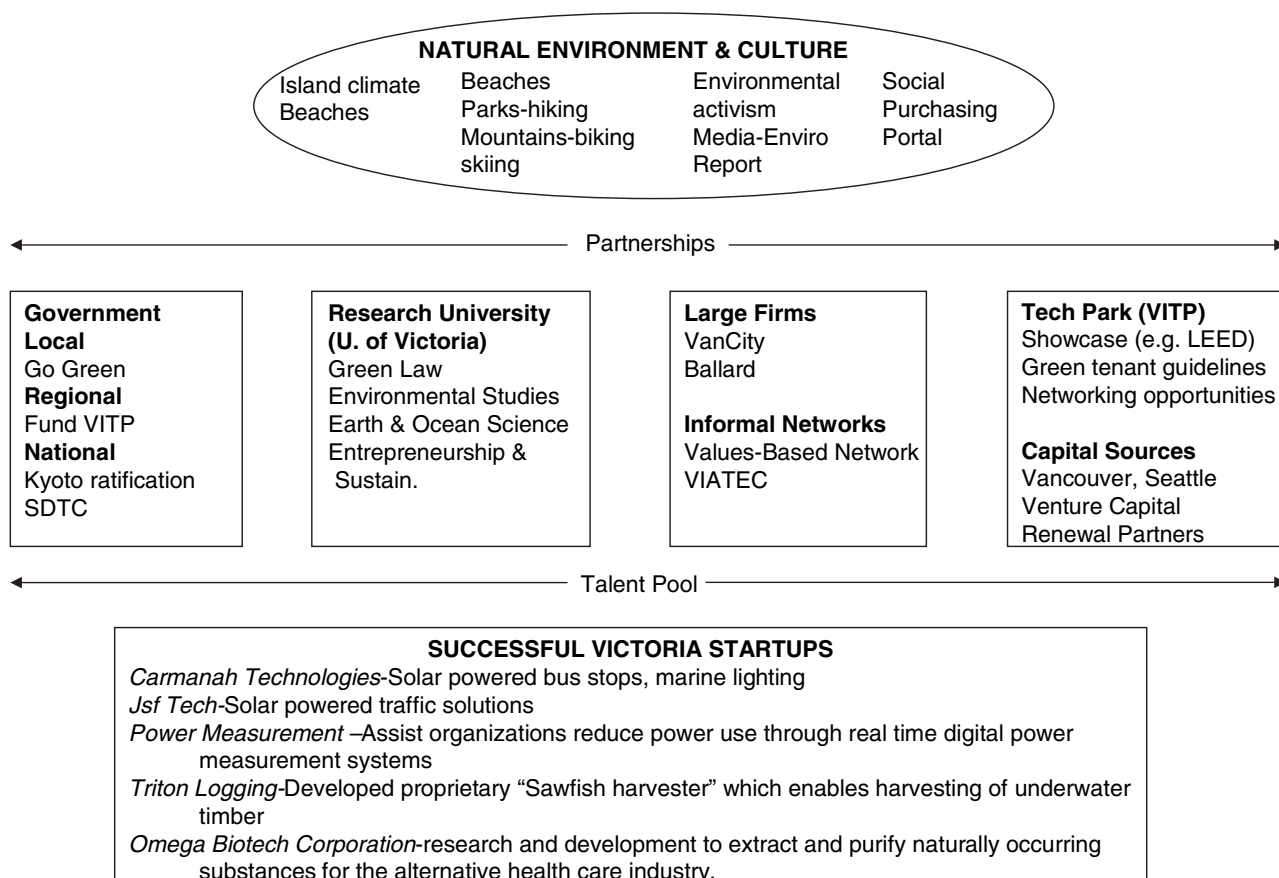


Figure 1. Sustainable Valley Portrait-Victoria B.C.

and only community with the potential to develop into a sustainable valley, but rather to be used for demonstration purposes. The role that the local environment plays in facilitating the development of an SEE may be of equal or greater importance than for other technology clusters (discussed below). The components of the ecosystem relating to the community will be analysed as they relate to the potential for encouraging sustainable entrepreneurship.

Before going into detailed analysis, an introduction to the community is necessary. Victoria is the capital of the Canadian province British Columbia. It resides on the southernmost tip of Vancouver Island off the coast of Vancouver. The greater Victoria area has a population of 300 000. Due to its mild climate, access to outdoor recreation and natural beauty (Victoria is known as the Garden City), the Victoria area receives approximately four million tourists annually. Because Victoria is the capital of British Columbia, a large percentage of employment is with government offices. As of January 2004, a total of 157 900 people were employed in greater Victoria. Approximately 20 percent of the labour market is employed by the government and health care agencies. Retail, accommodation and food industries make up another 27 percent of the labour market. Additionally, there are now approximately 1000 technology-based companies throughout Vancouver Island.

Presented below is a discussion of the core elements of the ecosystem as they relate to the creation of a sustainable valley. Each discussion is composed of three items: a summary of the component as described in the Boulder study, a theoretical linkage of that component to the concept of a sustainable

entrepreneurial ecosystem and finally a presentation of the current characteristics of that component in Victoria.

Social Networks

Networks play a critical role in supporting and facilitating entrepreneurship in a region (Birley, 1985; Prevezer, 2001). The strength of local networks for green start-ups may be even more critical. Green start-ups need to rely on a network of stakeholders (e.g. community groups, employees, customers) that have an understanding of sustainability issues and the unique challenges they face (Isaak, 2002). Green start-ups may also confront more costs than a traditional start-up (e.g. early implementation of an EMS system) and can therefore benefit greatly from the use of networks to share information and costs (Ammenberg and Hjelm, 2003). Neck *et al.* (2004), following Birley (1985), separated the social network into formal networks (university, government, professional and support services, capital sources, talent and large corporations) and informal networks (friends, families, colleagues and informal relations with similar companies). The following discussion examines networks in the same manner with respect to the creation of an SEE.

Informal Networks

Many new businesses rely on informal networks for advice, mentoring and moral support. In the Boulder study, 67 percent of founding entrepreneurs identified the informal network as an important piece of the entrepreneurial ecosystem. Research in industrial ecology has identified the important role that individuals play through their impact on physical systems and through their behaviour and values regarding the environment (Korhonen *et al.*, 2004).

In Victoria there are a few networks that have potential to develop a sustainable entrepreneurial ecosystem in Victoria. One organization is the Vancouver Island Advanced Technology Centre (VIATEC). VIATEC is a network of over 600 technology-based organizations on the island devoted to promoting the technology industry on the island. While VIATEC has yet to make a significant effort to promote sustainable technologies, many of its members have an environmental orientation, and thus it could be used in the future to promote a sustainable entrepreneurial ecosystem on the island. Another effort underway in Victoria, which is particularly promising, is known as the Values-Based Network (VBN). The VBN's mission is 'to develop and promote a sustainable business culture in their community'. The organization is in its infancy but has held a few meetings for current and future members, which have been very well received.

Formal Networks

The formal network is comprised of the presence of a research university, regional government agencies, professional and support services (e.g. lawyers, accountants, consultants, suppliers), capital sources (e.g. venture capitalists, business angels and banks), talent pool and large corporations (Table 1). In the Neck *et al.* study (2004), each of these components of the formal network ranged in perceived importance from 73 percent for both the university and for professional and support services to only 47 percent for large corporations. When taken together, the components of the formal network are critical for the

growth and evolution of an entrepreneurial system. Each of these will individually be discussed with respect to the creation of an SEE.

Research University

Since the inception of Silicon Valley, scholars have investigated the role that a research university can play in the development of an entrepreneurial system (Bruno and Tybjee, 1982; Bahrami and Evans, 1995; Neck *et al.*, 2004).

For an SEE to develop, the role of a research university may be at least as important as for the creation of a technology-based entrepreneurial ecosystem. By its nature, sustainable development requires inter-disciplinary expertise from sociology, political science, psychology, anthropology, engineering and biology to name a few (Korhonen *et al.*, 2004; Mihelcic *et al.*, 2003). Given the interdisciplinary nature of sustainability, a university should have faculty devoted to sustainability across many schools in order to develop graduates knowledgeable in sustainability and who are capable of starting sustainable ventures or succeeding as employees in sustainable ventures or as informed citizens and consumers (Mihelcic *et al.*, 2003). Therefore, a university plays a critical role in educating future leaders in its community who may not be predisposed to perceive the environment and business as diametrically opposed. Also, some of the technological solutions developed in a university context may have far-reaching sustainability impacts, *if* that university has an organization devoted to the commercialization of university-based innovations. Finally, universities can lead by example by managing themselves and growing in a sustainable manner.

Victoria has three institutions of higher learning, but only one research university (University of Victoria). The University of Victoria (UVIC) does have several programmes that relate to sustainability across the campus. These include the law school offering courses in green legal theory; an interdisciplinary programme offered by the school of environmental studies, a school and centre of Earth and Ocean Science, a Centre for Forest Biology and a business school which offers a sustainability curriculum including sustainable entrepreneurship (Figure 1). UVIC also has an organization devoted to technology transfer (Innovation and Development Corporation – IDC). However the IDC is not focused on or devoted to the commercialization of sustainable innovations. Also, despite calls from students and many faculties, UVIC was slow to react to criticism of how it expands into protected land, its role in creating traffic congestion in Victoria etc. Therefore it cannot be said that UVIC took a proactive stance in an effort to lead by example.

Government

Given the role that entrepreneurship is thought to play in local and global economies, governments have become increasingly interested in fostering a favourable climate for entrepreneurship through tax rates and incentives, providing other forms of affirmative financial support (e.g. subsidies and grants) and eliminating the bureaucratic ‘red tape’ often associated with applying for permits and licenses (Porter, 1998; Siegel *et al.*, 2003). Again, the role that government may play in fostering a climate conducive to the creation of an SEE may be even more profound. Innovative legislation and government cooperation (at federal, regional and local levels) may be necessary to transform markets when market forces are insufficient to compel firms to innovate for sustainability. Governments can play a critical role in compelling innovation through programmes such as green business plan competitions, rewarding firms who achieve innovations leading to resource conservation and supporting the introduction of sustainable high-technology development centres (Isaak, 2002).

With respect to Victoria, perhaps most important is the fact that the federal government ratified the Kyoto protocol in December 2002. The ratification of the protocol in Canada raised the level of public awareness regarding global warming and the need for reducing greenhouse gases (GHGs), and led to a commitment of \$1.7 billion (Canadian) towards GHG reduction. Other innovative programmes introduced at the federal level include increasing the ethanol content in gasoline and rebates to customers who implement green renovations in their homes.

Another unique effort by the federal government has been to develop an organization entitled Sustainable Development Technology Canada (SDTC). The mission of SDTC is to 'act as the primary catalyst in building a sustainable development technology infrastructure in Canada' (www.sdtec.ca). Started with a \$100 million investment (Canadian) by the federal government, SDTC was awarded another 200 million (Canadian) in March 2004 to continue with its mandate to provide start-up funding to firms developing promising sustainable technologies. A further discussion of funding sources in their role of cultivating an SEE will be discussed below.

Of course the role of local and regional governments cannot be overlooked in promoting an SEE. While there are still many challenges and missteps on its path towards a more sustainable future, the local and provincial governments have introduced several innovative programmes. The regional government in Victoria created 'GoGreen', which is devoted to greening the area through the promotion of alternative transportation, assisting organizations in reducing their environmental impact and educating the general public with respect to environmental challenges.

Another important role that government can play in supporting the growth of an SEE relates to partnerships with the private sector or non-government organizations (NGOs). Thus beyond legislation, regulation and tax incentives, governments can partner with organizations to combine forces in an effort to proactively foster SEEs. In fact, the SDTC has taken that approach as private organizations have contributed funding which surpassed the public funding levels.

Additionally, the provincial government provided a \$12 million investment to transform a former health care facility into a leading edge technology park in Victoria (Vancouver Island Technology Park – VITP). A separate section of this paper will discuss the technology park (www.vitp.ca) and its potential role in fostering an SEE in Victoria. A final example of innovative partnering with government agencies relates to a partnership between the City of Victoria, a local landfill and a private company, Maxim Power, to capture methane gas from the waste in the landfill and convert it into electricity to be purchased by the provincial utility company (BC Hydro).

Professional and Support Services

Professional and support services include entrepreneurial tax and legal support, and consultants, as well as the existence of supplier organizations that provide inputs that may go into the finished product. Professional and support services were identified by 73 percent of the respondents in the Boulder study as an important component of the entrepreneurial ecosystem.

Traditional business start-ups seek advice from various professionals during the incubation and start-up phase and usually do not encounter too much difficulty finding advisers with expertise in their industries. However, advisers to sustainable ventures can create barriers for successful start-up if they do not understand the challenges faced by these ventures (Schick *et al.*, 2002). Furthermore, advisers to start-ups often perceive environmental orientation to be a detriment to the firm's likelihood of growth and survival due to the perceived added financial strain (Schick *et al.*, 2002).

Victoria has yet to develop a strong base of local professional advisers. Victoria has a small, but fast growing, technology sector, which is slowly attracting advisers; however, the majority of professional

advising firms serving the Victoria market actually reside in the larger, neighbouring metropolitan cities, Seattle and Vancouver.

Capital Sources

Access to start-up capital for new ventures is of critical importance in the development of any technology sector from biotech (Prevezer, 2001) to data storage technology (Neck *et al.*, 2004). However, it can be difficult for sustainable entrepreneurs to find investors who share their values and understand the industries and environments in which they operate (Linnanen, 2002). While 'green capital' is evolving globally it currently represents less than one-tenth of one percent of the venture capital market (Randjelovic *et al.*, 2002).

In Victoria, the basic venture capital and 'angel' network is very small. Again, local firms that have had success in attracting start-up capital typically have to look to investors from other metropolitan markets who occasionally come to Victoria to look for prospects to enhance and diversify their investment portfolios. As far as 'green capital' is concerned, Victoria is also in short supply. There are a few venture capital organizations such as Renewal Partners, which are based out of Vancouver and focus on socially and environmentally responsible investing in British Columbia. Additionally, VanCity Credit Union has developed lending and grant programmes (entitled 'conservation financing') for for-profit sustainable ventures.

Talent Pool

Entrepreneurs need access to qualified employees if they are to build a successful, growing business. For example, in the Boulder study, 67 percent of the entrepreneurs surveyed identified access to qualified employees to be of major importance in the success of their ventures. If a region such as Silicon Valley develops a reputation for successful start-ups it has the potential to attract to the area more qualified workers who are seeking challenge, excitement and of course, wealth associated with stock options (Neck *et al.*, 2004). The ripple effect can occur as the number of firms focused on particular technologies or sectors (such as sustainable technologies) increases, as employees may leave one start-up and start their own venture or move to another venture. Victoria does show promise from the talent pool perspective because there is a growing technology base in the area and there are three institutions of higher learning in Victoria. However, barriers exist in Victoria because there are few large employers.

Large Corporations

Large corporations can play an important role in the evolution of an entrepreneurial system through training and skill building of local employees and through unintentional spin-offs created by employees of large firms who were either laid off or leave their current company to start a new business opportunity (Neck *et al.*, 2004). Large corporations can also provide the foundation for a technology base in an area. On the sustainability agenda, large firms can play a role in fostering sustainable entrepreneurship through requiring their suppliers to meet environmental standards such as ISO 14001, or by creating markets for innovative sustainable technologies, or leading the way with industrial ecology efforts.

For example, Vancouver is the home to Ballard Power Systems, widely considered to be the creator of the fuel cell industry. As a result, several fuel cell firms have been founded in British Columbia. Another example of a larger company impacting the local community, VanCity Credit Union, last year had net earnings of over \$40 million and allocated \$13.5 million back to its members and the community. Aside from their conservation financing programme, VanCity has other innovative programmes which con-

tribute to sustainable innovation, such as a 'prime + o' car loan programme for buyers of hybrid vehicles, and a credit card, 'Enviro card,' which donates five percent of its annual profits towards environmental projects in the community. While these are a few examples of large firms contributing to the local community, there are very few large employers in Victoria, as most employment is in the government and hospitality sectors. There is, however, a small but growing technology sector on the island.

Technology Parks

While the Boulder study did not address technology parks, it is appropriate to consider the role that technology parks can play in fostering entrepreneurial ecosystems. Technology parks are typically designed to support high potential, growing technology business through the provision of office space and shared access to conference rooms, other support services and networking connections with professional advisers and investors. Technology parks, if in close proximity to a research university, can have a significant impact on the growth and evolution of technology businesses in a community (Lalkaka, 2002).

In recent years, the development of ecologically based technology parks (eco-industrial parks) has received much attention in the media and in scholarly journals (e.g. van Leeuwen *et al.*, 2003; Lambert and Boons, 2002). The most advanced eco-industrial parks attempt to emulate nature through biomimicry (Benyus, 1997), whereby closed-loop systems are implemented to minimize the collective environmental impacts of the firms located in the park through waste management and reuse and energy reduction (van Leeuwen *et al.*, 2003).

While Victoria does not technically have its own eco-industrial park, it has something of a hybrid between a technology park and an eco-industrial park. Whereas eco-industrial parks are typically geared towards established firms, technology parks commonly seek to facilitate the growth of new firms. The technology park in Victoria, VITP, seeks to showcase British Columbia and Victoria as a place for start-up technology firms. While technology parks typically overlook the environmental impacts of the park itself and the firms that reside there, the VITP has taken a proactive stance towards raising environmental awareness of its tenants. The VITP was the first building in Canada to receive the LEED gold award for environmental building design. This and other efforts of the VITP, such as the establishment of 'green tenant guidelines,' have shown that the technology park can be an instrumental player in attracting sustainable entrepreneurial ventures to the area. For example, the Canadian Green Building Council was co-founded by one of the developers of the VITP and the Council is a tenant of the park. The park is also home to several life science and biotechnology start-ups including Aspreva Pharmaceuticals Corporation, which raised \$76 million in venture capital in early 2004 to develop clinical trials throughout the world to fight lupus and several skin disorders. It is hoped that this investment will attract more investors to the area.

It's absolutely perfect news. It's probably the most significant bit of financing in that sector in North America. It will put Victoria on the map and make people look at the life sciences industry here (Bill Cooke, CEO of VIATEC) (*Goldstream Gazette*, 12 March 2004).

Physical Infrastructure

The physical infrastructure of a community, such as the availability and relative costs of real estate (commercial and residential) and the quality of traditional and alternative transportation, also play a role in the growth of an entrepreneurial ecosystem in a geographic location. Because entrepreneurs often have the choice to start their venture where they would like, they often choose to locate their ventures in places

considered to be a good place to live and raise a family. In the context of sustainable entrepreneurs, it may also be expected that they would seek to locate their businesses in places with easy access to outdoor activities, in good climates etc. The problem with this is that locations like these are somewhat rare and as a result, land prices tend to be expensive. This problem can be exacerbated by public pressure to limit new construction and growth due to the desire to maintain the natural environment. Most regions where entrepreneurial ecosystems develop, such as Boulder, Austin and, of course, Silicon Valley (where the median home price is about four times the U.S. average, Kerstetter *et al.*, 2003), face this very issue. The result is that it can become cost prohibitive to locate and grow a venture in some of these areas either due to lack of available commercial space or because exorbitant residential real estate prices make it difficult if not nearly impossible for entry level employees to afford local housing. Victoria has experienced escalating real estate prices over the past several years and is considered one of the most expensive real estate markets in Canada.

Another limitation of the physical infrastructure in Victoria is the fact that it is isolated on an island. While Victoria is physically close to the major urban centres of Seattle and Vancouver, airplane or ferry travel is required to transport goods or individuals to the 'mainland'. This can lead to cost-prohibitive shipping costs for young, vulnerable start-up firms.

Culture

The community culture can have a profound impact on the evolution of an entrepreneurial ecosystem. In the Neck *et al.* study (2004) culture was the only component of the ecosystem that achieved unanimous support as beneficial and critical to the development of the system. Broadly defined, culture includes the natural landscape and climate of the region, the collective interests and knowledge of its citizens and the collective spirit of the community. Culture may be the single most important element for an entrepreneurial ecosystem to develop; however, it represents probably the most difficult component for a community to manage and replicate (Neck *et al.*, 2004).

If community culture is critical for the evolution of an entrepreneurial ecosystem, it is fundamental for the development of an SEE. Accumulated local knowledge and culture have a profound impact on the pursuit of a sustainability agenda in a community (Ruddle, 2000). Local press can play a role by raising the collective consciousness of environmental issues, which can help facilitate changing values in a community (Nissani, 1999).

The quality and quantity of outdoor recreational activities and natural landscapes can also play a role in developing a community conducive to the development of an SEE. Access to outdoor recreational activities (e.g. hiking and biking trails, parks) can aid in attracting individuals who have a genuine concern for the natural environment. Individuals who value the environment may also be more likely to work for, or start, sustainable ventures.

Generally speaking, the culture in Victoria is particularly conducive to the development of an SEE. As is typical in the Pacific Northwest of the U.S., British Columbia and Victoria have their share of nature lovers and environmental activists. Media attention to environmentally questionable practices is constant in Victoria. A local news channel, 'The New VI', airs a weekly segment on environmental challenges and successes in the area. In another example, media coverage helped raise the spotlight on clearcutting practices in Clayoquot Sound in 1993. More than 10 000 people demonstrated against the practice and 857 protestors were arrested.

As for the availability of outdoor pursuits, Victoria has a multitude of options. Because it is on an island, and it has a mild climate, there is nearly year round access to hiking and biking trails, and beaches. The island even has its own wintertime ski resort just 2½ hours north of Victoria. Again, Figure 1 depicts the elements of the entrepreneurial ecosystem in Victoria that are contributing positively

towards the development of an SEE. Below I briefly introduce some barriers to the development of an SEE and then pose some future research questions.

Barriers and Limitations of Sustainable Entrepreneurial Ecosystems

Several barriers and limitations to the development of SEEs exist. One barrier is the difficulty of maintaining a high quality of life in a region through growth restrictions while at the same time being conducive for starting growing businesses. Additionally, there is a 'chicken and egg' problem with investors and successful start-ups, in that equity investors prefer to wait to establish offices in an area until there is a critical mass of high growth start-ups. The problem is that it is hard for start-ups to grow without sufficient access to capital. Also, it is possible that a geographic region could develop a niche specialty in a particularly environmental technology, which could result in technology lock-in. For example, Victoria is home to a few start-ups focused on the application of solar power (see Figure 1). A cluster of firms in the area focusing on solar power applications could be problematic if another technology (such as wind power) becomes the dominant technology for harnessing renewable energy. Finally, overcoming the dominant business paradigm (that sustainable development is an oxymoron), even in a community such as Victoria, can be a nearly insurmountable challenge for those seeking to develop an SEE.

Discussion and Future Research

This research aspired to gain insights into the applicability of the entrepreneurial ecosystems literature to the potential for the development of a sustainable entrepreneurial ecosystem (SEE), or 'sustainable valley'. Several challenges were identified to the accomplishment of such an objective, utilizing Victoria, British Columbia, as a model.

Although Victoria faces some challenges, there are signs that the system is beginning to have a positive impact on the development of successful, sustainable ventures. The bottom of Figure 1 depicts a few of the local success stories. Carmanah Technologies, founded in 1998, develops solar-powered LED lighting solutions for bus stops, transit and marine uses. Carmanah was ranked in the top ten of for Canada's fastest growing companies. In a similar vein, JSF Technologies has developed 'Active Beacon', which is a solar powered, wireless crosswalk warning device. Founded in 1984, Power Measurement helps organizations reduce power use through real time digital power measurement systems. The Power Measurement CEO, Brad Forth, was named Entrepreneur of the Year by Ernst & Young in 2003. Triton Logging and Omega Biotech Corporation are two more examples of promising sustainable technology firms founded in Victoria. While not conclusive, the success of these and other young growing firms suggests that Victoria may have the makings to leverage its SEE components towards a leadership position within Canada as 'the place' to start a sustainable venture.

Future qualitative research should examine how each one of the elements of the entrepreneurial ecosystem can be developed and maintained. A related question would be to examine how each component of the entrepreneurial ecosystem is interdependent on the others, and what impact a weakness in particular components has on the entire system. Prior research has suggested that business ecosystem effectiveness is dependent on the strength of each individual component and, thus, a weakness in one component decreases the performance of the entire ecosystem (Iansiti and Levien, 2004). This leads to another interesting question: are certain components more important than others in the early development of an SEE? For example, what component of the system must be in place before further development can happen? Figure 1 suggests that perhaps the backbone of an SEE is the natural environment

and culture of the community. Could such a system develop in a community that lacked a quality natural environment or culture towards sustainability?

A longitudinal research programme could examine the chronological development of SEEs. Perhaps each one would and should develop in its own way, leveraging the strengths of each local community. Furthermore, once some level of success has been attained, longitudinal research could examine the role that reputation for sustainability plays in attracting employees and sustainable entrepreneurs to the community. In the Boulder study (Neck *et al.*, 2004), one entrepreneur specifically spoke about the positive connotation that having a Boulder address has for start-up technology firms, particularly in the data storage area. A quote from the Vancouver Island Technology Park's (VITP) 'Green Tenant Guidelines' suggests that local leaders believe that Victoria could very well develop such a reputation:

As part of the New Economy's 'footloose industry', technology companies are drawn to, and motivated to stay in, areas offering a higher quality of life. There is widespread evidence of the importance of a clean environment and other quality of life considerations in the location decisions of these firms.

The Vancouver Island Technology Park (VITP) has been developed as a showcase, high performance (i.e., 'green') building to further the principles of environmental and community stewardship thereby enhancing the image of Greater Victoria and the Capital Regional District (CRD) as a place where technology entrepreneurs and workers want to live, work and play (www.vitp.ca).

Conclusion

Researchers and entrepreneurs are only just beginning to realize the potential impact that innovation might play in changing the way we live, work and interact with our natural environment. Utilizing an entrepreneurial ecosystems approach, this research sought to explore the relevance of multiple components of the economic environment that may contribute to (or detract from) the building of an SEE. It is hoped that this research may inspire other researchers, entrepreneurs and community economic developers to explore the development of SEEs in communities throughout the world. This may be one important piece of the puzzle to reach our ultimate goal: 'to meet the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987).

References

- Ammenberg J, Hjelm O. 2003. Tracing business and environmental effects of environmental management systems – a study of networking, small and medium-sized enterprises using a joint environmental management system. *Business Strategy and the Environment* 12(3): 163–174.
- Bahrami H, Evans S. 1995. Flexible re-cycling and high-technology entrepreneurship. *California Management Review* 37(3): 62–89.
- Benyus JM. 1997. *Biomimicry: Innovation Inspired by Nature*. Morrow: New York.
- Birley S. 1985. The role of networks in the entrepreneurial process. *Journal of Business Venturing* 1(1): 107–117.
- Bruno AV, Tyebjee TT. 1982. The environment for entrepreneurship. In *Encyclopaedia of Entrepreneurship*, Kent CA, Sexton DL, Vesper KH (eds). Prentice-Hall: Englewood Cliffs, NJ; 288–315.
- Cohen B, Winn M. 2003. Market imperfections, opportunity and sustainable entrepreneurship. Presented at the Greening of Industry Network Conference, San Francisco, 2003.
- Esty D, Porter M. 1998. Industrial ecology and competitiveness: strategic implications for the firm. *Journal of Industrial Ecology* 2(1): 35–44.
- Florida R, Kenney M. 1988. Venture capital and high-technology entrepreneurship. *Journal of Business Venturing* 3(4): 301–319.
- Iansiti M, Levien R. 2004. Strategy as ecology. *Harvard Business Review* 82(3): 68–79.
- Isaak R. 2002. The making of an ecopreneur. *The Journal of Corporate Environmental Strategy and Practice* 38: 81–91.

- Kerstetter J, Himelstein L, Mullaney T. 2003. Still the centre of this world. *Business Week* 3846: 76.
- Korhonen J. 2004. Industrial ecology in the strategic sustainable development model: strategic applications of industrial ecology. *Journal of Cleaner Production* 12: 809–823.
- Korhonen J, von Malmborg F, Strachan P, Ehrenfeld J. 2004. Management and policy aspects of industrial ecology: an emerging research agenda. *Business Strategy and the Environment* 13: 289–305.
- Lalkaka R. 2002. Technology business incubators to help build an innovation-based economy. *Journal of Change Management* 3(2): 167–176.
- Lambert AJ, Boons FA. 2002. Eco-industrial parks: stimulating sustainable development in mixed industrial parks. *Technovation* 22(8): 471–484.
- Linnanen L. 2002. An insider's experiences with environmental entrepreneurship. *The Journal of Corporate Environmental Strategy and Practice* 38: 71–80.
- Malecki EJ. 1997. Entrepreneurs, networks, and economic development. *Advances in Entrepreneurship, Firm Emergence, and Growth* 3: 57–118.
- Mihelcic J, Crittenden J, Small M, Shonnard D, Hokanson D, Zhang Q, Chen H, Sorby S, James V, Sutherland J, Schnoor J. 2003. Sustainability science and engineering: the emergence of a new metadiscipline. *Environmental Science and Technology* 37(23): 5314–5324.
- Neck H, Meyer D, Cohen B, Corbett A. 2004. An entrepreneurial system view of new venture creation. *Journal of Small Business Management* 42(2): 190–208.
- Nissani M. 1999. Media coverage and the greenhouse effect. *Population and Environment* 21(1): 27–33.
- Porter M. 1998. The Adam Smith Address: location, clusters, and the 'new' microeconomics of competition. *Business Economics* 33(1): 7–13.
- Portney K. 2003. *Taking Sustainable Cities Seriously: Economic Development, the Environment, and Quality of Life in American Cities*. MIT Press: Cambridge, MA.
- Prevezer M. 2001. Ingredients in the early development of the U.S. biotechnology industry. *Small Business Economics* 17(1): 17–29.
- Randjelovic J, O'Rourke AR, Orsato R. 2002. The emergence of green venture capital. Presented at the Greening of Industry Network Conference, Goteborg.
- Ruddle K. 2000. Systems of knowledge: dialogue, relationships and process. *Environment, Development and Sustainability* 2(3/4): 277–304.
- Schaper M. 2002. The essence of ecopreneurship. *The Journal of Corporate Environmental Strategy and Practice* 38: 26–30.
- Schick H, Marxen S, Freimann J. 2002. Sustainability issues for start-up entrepreneurs. *The Journal of Corporate Environmental Strategy and Practice* 38: 59–70.
- Shepherd J. 1987. Manufacturing in Britain: industrial support policies. *National Institute of Economic Review* 122: 59–71.
- Siegel D, Wessner C, Binks M, Lockett A. 2003. Policies promoting innovation in small firms: evidence from the U.S. and U.K. *Small Business Economics* 20(2): 121–127.
- Spilling OR. 1996. The entrepreneurial system: on entrepreneurship in the context of a mega-event. *Journal of Business Research* 36(1): 91–103.
- Van de Ven AH. 1993. The development of an infrastructure for entrepreneurship. *Journal of Business Venturing* 8: 211–230.
- van Leeuwen MG, Vermeulen WJ, Glasbergen P. 2003. Planning eco-industrial parks: an analysis of Dutch planning methods. *Business Strategy and the Environment* 12: 147–162.
- World Commission on Environment and Development (WCED). 1987. *Our Common Future*. Oxford University Press: Oxford.

Biography

Boyd Cohen

University of Victoria, Faculty of Business, P.O. Box 1700 STN CSC, Victoria, BC V8W 2Y2, Canada
 Tel.: (250) 721-6401
 Fax: (250) 721-6067
 E-mail address: bcohen@uvic.ca