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Community Vitality: The Role of Community-Level Resilience Adaptation and Innovation in Sustainable Development

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Abstract: Community level action towards sustainable development has emerged as a key scale of intervention in the effort to address our many serious environmental issues. This is hindered by the large-scale destruction of both urban neighbourhoods and rural villages in the second half of the twentieth century. Communities, whether they are small or large, hubs of experimentation or loci of traditional techniques and methods, can be said to have a level of community vitality that acts as a site of resilience, adaptation and innovation in the face of environmental challenges. This paper outlines how community vitality acts as a cornerstone of sustainable development and suggests some courses for future research. A meta-case analysis of thirty-five Canadian communities reveals the characteristics of community vitality emerging from sustainable development experiments and its relationship to resilience, applied specifically to community development.

Keywords: sustainable development; community vitality; resilience; innovation; adaptation; case study research

1. Introduction

The environmental movement, and the parallel in international policy development, has evolved significantly since its modern rise to prominence in the early 1960s with, amongst other events, the publication of Silent Spring [1] and the resulting activism and political resurgence that followed. Beginning as a grass-roots movement against very specific threats, the environmental movement

evolved into an effort of international scope. The maturing UN policy agenda starting with the Intergovernmental Conference for Rational Use and Conservation of Biosphere in 1968 and culminating in the production of the Brundtland report "Our Common Future" [2] and Agenda 21 [3]. While these various international policy outcomes were the products of intense diplomacy, contained visionary ideas and concepts, and were grounded in significant scientific research, the outcome and impact of this effort was rather disappointing in some ways. The impact of humanity on the planet is increasing not decreasing [4] and the gap between rich and poor is growing [5]. Through to the early to mid 2000s the movement focused most heavily on individual action to address large "world problematiques" perhaps best typified by the work of Al Gore, with little international level success. This slow uptake, however, does not reflect lack of urgency or lack of will; rather, as we have argued elsewhere, scale is important in the area of environmental intervention [6] and the scale at which we engage with environmental issues is no different. International efforts can be powerful, as in the case of addressing the ozone crisis, but they are also slow and cumbersome and often either fail or become ineffectual. Individuals, on the other hand, have good control over certain elements of their lives, such as purchasing power, but have little to no direct control over urban planning and energy supply. Environmental action at the very large and very small scale might now be revealing its intrinsic limits. Indeed, the further we get away from an individual tending his or her own garden, the less effective planning and management decisions are, yet the probability of achieving sustainability decreases at finer scales [7].

More promising efforts are being seen at the community scale. In our research tracking positive community level efforts to encourage sustainable development in a wide variety of fields such as transport, energy, and infrastructure, we found examples that strongly suggest that it is at the community scale that the application of innovation, both technological and social occurs most effectively, and, when aggregated has the greatest impact in increasing sustainability at a broader scale. It is this scale therefore that is most important in the struggle to 'craft' a more sustainable world. Communities can be defined broadly, not only by place, but also overlapping communities of practice [8], professional affiliation, shared interests and networks [9], and space, that is, virtual communities. In addition, the label "community" requires that the constituent population has formed a regularly interacting system of networks [10]. This research focuses on 'communities of place' [11] as being where the interface between social capital and the environment occurs, but it also recognizes that virtual communities have great influence on the place based actions and innovations that result in sustainable community development.

Unfortunately communities in both rural and urban settings have been under unprecedented attack in the second half of the twentieth century [12,13]. Single industry and resource towns have been hit hard by the globalization of the economy and policies to create highly skilled and mobile workforces, while arguably increasing the economic opportunities for individuals, have worked against the stability and social health of communities. Planning orientated around car mobility rather than people has created infrastructure and places where chance social interactions are reduced, where people are isolated from the natural world and where streets and downtowns are increasingly empty places [14]. Such planning has also increased the homogeneity of residential areas, decreasing social-economic and cultural diversity in these places. All these developments make it harder for communities to thrive.

Some communities, however, remain strong in the face of external challenge. They possess what we call "community vitality"; they are resilient, they are innovative, and they are adaptive. Simply put, a vital community is one that can thrive in the face of change. It is a place that can remain at its core a functional community without loss to ecological, social and economic capitals in the long run, whatever occurs as a result of exogenous changes beyond its control. And perhaps more importantly, it is a place where human systems work with rather than against natural systems and processes.

2. Lessons from Sustainable Development

Community acts as a stage for environmental intervention and as a support network and empowering agent for those who wish to address environmental issues. Established communities have a sense of place; place has emerged as a feature of sustainable communities and sustainable development projects have been proposed to strengthen sense of place. Several writers have explored the importance of place, and a sense of place, growing from work pioneered by early writers in the area of human geography [15-17]. This dialogue has grown to include discussion of quality of life, the liveability, and the sustainability of human communities [14,18]. In contrast, the suburban form that arose in the latter half of the twentieth century embodies a placelessness summed up well by Debord's description of the suburban landscape as conforming to the motto "on this spot nothing will ever happen and nothing ever has" [19]. Orr maintains that the weakening sense of place is at the heart of our ecological crisis [20]. It is possible place is a necessary condition for the implementation of sustainable development.

The discourse of sustainable development itself has also changed since its broad scale recognition in 1987 through the publication of the Brundtland Commission Report. The early conceptualizations of sustainable development were very goal oriented and the movement now is much more process-oriented. As Holling argues, "sustainability is the capacity to create, test, and maintain adaptive capability. Development is the process of creating, testing, and maintaining opportunity. The phrase that combines the two, 'sustainable development' thus refers to the goal of fostering adaptive capabilities and creating opportunities. It is therefore not an oxymoron but a term that describes a logical partnership" [21].

Treating sustainable development as a process creates the need for an indefinite program of monitoring and adjustment. Every successful adaptation is only a temporary "solution" to changing selective conditions [22]. In short, sustainable development is a moving target. In some cases, the time spans involved are long to the point of being indefinite. This need for a continuous process arises due to two factors; the inherent unpredictability of complex adaptive systems, and the changes brought about by human innovation.

This approach is a shift from a command and control model of sustainable development to a self-organizational model of dynamic sustainable development, a model more suited to the community scale. Such a model is more likely to be successful as it can emerge organically from unsustainable behaviour in manageable steps. Norms cannot be imposed in advance [23], but will emerge as part of an adaptation process. Instead of being a final objective, sustainable development has to be understood as a continuous process of change [24], and a fruitful approach to this process is to treat it as an evolution [22]. This shift to a concept of sustainable development as an evolving target explains why

adaptability and innovation are as important as resilience, and why the early environmental movement's focus on looking back to a simpler time was not a successful strategy. Sustainable communities need the ability to embrace change and the tools to address such change.

Results from the previous five-year research agenda found that place [25] matters deeply to many Canadian communities, but there is little awareness of the aggregate impacts of human scale [6], the need for limits [26] and their subsequent impact on diversity [27], particularly biodiversity.

3. Research Methodology

This article builds upon the investigations of the Canada Research Chair (CRC) research program led by the first author from September 2004–September 2009, continuing to use a mixed-methods and contextual, comparative case study [28] approach. Case study methodology is particularly useful for addressing questions regarding the how and why of phenomena and in providing details about specific behaviours, a particularly necessary approach for the exploration of community vitality. The great strength of the case study is it provides a sense of context and a richness of detail that exceeds virtually every other approach to analysis [29]. Each case study, individually and in its contribution to larger analysis, acts as a heuristic for interrogating larger theories. A contextual comparative case study examines the commonalities and difference in the events, activities, and phenomenon that are the units of analysis in a typical case study. The purpose of engaging in cross-case or meta-case analysis is to enhance the researcher's capacity to understand how relationships may exist among discrete cases in order to refine concepts and build or test theory. Yin [28] adds that case study methodology is well suited to 'how' questions. The approach of using multiple settings allows for the data source triangulation explained by Denzin [30] in which the research compares the data generated in different contexts. Yin [28] suggests two principles of data collection that were used for this research: the use of multiple sources of data and the creation of a case study database (see www.crcresearch.org which contains summaries of all the case studies referred to in this article).

The case studies were chosen based on a number of criteria. All except on Australian example they were selected as leading Canadian examples of the development of sustainable infrastructure and the process sustainable community development. The cases in sustainable infrastructure were selected based on three key attributes: integrated planning, transformation and innovation, and transferability, as well as for scalability, adaptability, and resilience. The overall set was selected for a diversity of geographical region, economy, and project and community sizes within the Canadian context. Cases studies in sustainable community development were selected as they demonstrated explicit (and implicit) links among and between four substantive "pillars" of the Canada Research Chair in Sustainable Community Development—place, scale, limits and diversity.

Each case study was developed using a variety of sources in order to triangulate the information. Data was drawn from other published information, internal documents and web-sites, and interviews. The precise nature of these varied from case to case depending on the specific context and nature of each case.

For the purposes of this discussion, a meta-analysis of the thirty-five case studies from the first five-year research program were analyzed to indentify characteristics of community vitality common to all the cases. The data was then analysed for emergent common themes. Critical success factors

from each case were identified and then categorized according to the emergent themes. The nascent characteristics derived from this meta-case study analysis are detailed below.

We hypothesize that a vital community practises some form of what we have identified as anticipatory governance. Humans group for social reasons, of course, but also group in order to tackle challenges that are beyond the scope of individual action. A community that has richer groupings for the first reason is surely better placed to respond should the second condition arise. Communities are both proactive and reactive; ideally they plot a course forward in order to achieve common goals, and at the same time they are ready for any challenges that come their ways. Living beings and complex systems are influenced by and adapt to their surroundings. Communities are no different. They are always influenced, and changed, by their surroundings. Sustainable communities adapt and work within their environment rather than against it. A community that is 'vital', however, does more than adapt and mitigate, it anticipates, designs and redesigns as it adapts. Or, if it cannot or fails to anticipate, then it contains within it the diversity and redundancy necessary to adapt in a way that prevents harm. This balance of adaptation and resilience creates communities that are living complex adaptive systems, changing as needed yet maintaining their identity.

Previous research reveals that communities currently face an array of social, ecological, and economic challenges, and their response to these challenges is mixed; while some communities struggle to survive, others thrive [31]. Understanding community vitality, why some communities are resilient, adaptive and innovative in the face of change and others are not, is a pressing research question. We are assuming that at least some degree of community vitality is necessary to stimulate the creativity, partnerships and trans-disciplinary relationships we have established are necessary for sustainable community development. We also suspect there is a strong place consideration—perhaps the spaces in which social interaction can occur, perhaps the invisible influence of dominant ecological features on creativity and thought within a community. In effect, a lack of vitality is a form of poverty that will mitigate against the development of these aspects of sustainable development. If this is the case then there should be some evidence of vitality within each and every case study. That does not necessarily mean that every community represented by a case study could be described as vital, it is also possible that vitality could be created through the partnerships developed by the sustainability project itself.

4. Community Vitality and Resilience

What exactly is resilience? Walker describes resilience as "the capacity of a system to undergo change and still retain its basic function and structure" [32] (online), an ability that is partly manifest through the proper functioning of governments. One definition of resilience is "the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change" [33]. Resilience has also been defined as the capacity to deal with complex issues widely dispersed across a set of loosely connected actors [34], a definition that speaks to the collective. However, resilience is also a function of the social networks contained in a community. Resilience emerges from intra-scale and cross-scale interaction, however understanding the nature of resilience across scales is difficult because of dominance of different processes at different scales, non-linearity, and emergent properties [35], as well as human dynamics. Social resilience can be

measured by proxy, using indicators such as the variability of income, stability of livelihoods, wealth distribution, and demographic change [33] and agency [36].

One of the ways communities respond and exhibit resilience is through their ability to innovate. Innovation is more than new technology; technical ingenuity creates new technology, but social ingenuity reforms old institutions and social arrangements into new ones [37]. Innovation in a complex society occurs, however, on many scales. At the smaller scale we see incremental innovations, which are small refinements that occur relatively continuously. Such sudden shifts can provide new technologies to protect ecosystems, can shift our resource use from one resource base to another, and can also increase our impact on ecosystems in new and unexpected ways. Somehow we have to have some idea of what effect an innovation might have.

Incorporating innovation into a model of sustainable development is difficult. Though technology can be seen as an "adaptive answer" to problems [22]; there is inherent uncertainty in the predicted outcomes of innovation [38]. For example, expectations of the computer revolution were a significant reduction in the use of paper, when in fact the opposite has occurred, a significant increase in its use. Innovations can give rise to new needs, but they introduce variation and learning that is essential to the exploration and development of new possibilities [39]. Some of our problems require systems innovations which enable the fulfillment of needs in an entirely new manner, yet planning is difficult when things useful to us today may be of no use in the future and things we do not value may be essential to humans living in the future [40]. This is the connection between adaptation and innovation, the latter is a sufficient and necessary continuation for the former. Our ability to use innovation can be described as our ability to be adaptive.

Diversity is also key to all three anticipated heuristics of community vitality—resilience, innovation and adaptation. Thus, it is keystone to both resilience and a community's ability to adapt. With respect to innovation, Hamel [41] argues that strategic innovation is the result of bringing a diverse set of voices into the strategy dialogue, among other issues. Further, there is evidence that minority opinions stimulate creativity and divergent thought which, through participation, manifest as innovation [42]. What, then, does the meta-analysis of the thirty-five case studies reveal about community vitality, resilience and innovation?

5. Nascent Characteristics

A qualitative meta-case analysis [28] of the thirty-five case study communities reveals common features we assume are characteristic of community vitality. A summary of the thirty-five case studies is provided in Table 1. Each case was read through and key elements of the case were extracted into a table and then categorized. These categories pertained to the characteristics of the case, and in particular to the elements identified as critical success factors. The categories that were identified in the majority of the cases, and which pertain to the community context in which the case was situated were those described below. Other categories which either didn't relate to the majority of the cases, or which are not relevant to the community context included technological innovation, focus on food, ecological conservation and protection.

Table 1. Case study summaries, the detailed cases can all be read at http://crcresearch. royalroads.ca/case-studies/case-studies.

Case Study	Case Summary
A Microgeneration Strategy for Canada	This case provides an overview of the potential for microgeneration energy in Canada. It examines the opportunities that microgeneration represents, and argues that this opportunity is being taken by other jurisdictions, while Canada lags behind.
Deep Water Cooling	This case compares deep water cooling systems in Halifax, Nova Scotia and Toronto, Ontario, and describes their ecological and long term economic benefits.
Energy Efficiency for Homeowners	This research examines why homeowners took part in the EnerGuide for Houses program in Halifax, Nova Scotia, and what were the barriers to participation.
Energy Performance Contracting	The City of Toronto, Ontario has actively provided support for the use of energy performance contracting (involving comprehensive energy and water retrofits and building renewal initiatives) with respect to both private and public buildings located within the City.
Renewable Energy on Prince Edward Island	Despite its population of just 138,000, the Province of Prince Edward Island has undertaken an ambitious renewable energy strategy that has delivered innovative policies, public engagement strategies and economic benefits.
Wind Power Generation	Several initiatives are proposed that directly link wind power to the needs of nearby communities, such as the Wolfe Island Wind Project at Kingston, Ontario.
EcoPerth	EcoPerth is a non-profit organization that was created in 1997, primarily to address climate change issues within the town of Perth, Ontario (population approximately 6,000) and the surrounding rural area.
Mid-term Objectives: An Urban Experience. Toronto, Ontario	The City of Toronto, Ontario in 1990 committed to reduce carbon dioxide emissions by 20% by 2005, relative to 1988 levels. To implement these mid-term objectives, the City has put in place several mechanisms including: The City of Toronto's Energy Efficiency Office (EEO); and the Toronto Atmospheric Fund.
Towards Green Buildings: Calgary	The City of Calgary, Alberta was the first jurisdiction in Canada to adopt a sustainable building policy in 2004, a policy that, amongst other things, commits all City-owned building developing new and under-taking major renovations of occupied facilities to meet or exceed the silver level of the Leadership in Energy and Environmental Design (LEED) standard.
United We Can	In five years, United We Can, a downtown eastside Vancouver, British Columbia recycling project, evolved from a loose *ad hoc* network of "binners" (dumpster divers) into a thriving business enterprise and an increasingly healthy community of workers engaged in providing an essential recycling service to their broader community.

Table 1. *Cont.*

Case Study	Case Summary
Long Term Planning Initiatives	The case examines three cities with different approaches to long-term planning. Edmonton, Alberta has a fiscal approach, considering the costs associated with the replacement of current infrastructure and setting out strategies to manage the replacement over time. Ottawa, Ontario and Calgary, Alberta both start from a vision document for the city involving community participation and long-term planning horizons. Ottawa employs 'Smart Growth' principles and Calgary uses the 'Triple Bottom Line'.
Triple Bottom Line in Practice: From Dockside to Dockside Green	This case explores the planning process that has led to the re-development of the Dockside area of the City of Victoria, British Columbia. The adoption of a tendering process for potential developers based on Triple Bottom Line (TBL) methodology has meant that smaller, more progressive development companies were able to compete for the land, although the social imperative was comprised in the long term.
What Makes a City Liveable?	This case looks at two communities of very different sizes, the Town of Okotoks, Alberta and the City of Vancouver, British Columbia, both of which have been attempting to implement development based on quality of life and sustainable development for a number of years.
Alternative Road Allocations, Whitehorse	This case study examines the practice of converting existing four-lane roadways to multimodal two-lane roads, often referred to as alternative road allocations using Fourth Avenue and Quartz Avenue, in Whitehorse, Yukon Territory to illustrate the process.
Integrated Transportation Strategies	In 2002, the town of Mont Saint-Hilaire, Quebec put in motion the development of a multi-functional suburb focused around a new heavy-rail commuter station providing service to downtown Montreal, Quebec.
Mobility HUBs, Toronto, Ontario	The concept behind the New Mobility HUB project is to fill in these gaps with a network of hubs across Toronto, which link multiple modes of sustainable transportation.
Sustainable Transportation	The case study examines whether mass transit systems can be used as a tool to encourage the development of sustainable communities. The case examines a proposed expansion to the Montreal, Quebec commuter rail system.
Green Waste Programs	This study focuses on two examples of organic waste collection—one province wide in Nova Scotia and one city wide in Whitehorse, Yukon Territory. These were chosen to provide two examples contrasting provincial with town scale systems, and where the collection stands alone or is integrated into a comprehensive waste management strategy.
Storm Water Management	This case study documents some of the innovative approaches being undertaken to mitigate contaminated urban storm run-off in Chilliwack, British Columbia, and Toronto, Ontario.
Airshed Improvement: Stakeholder perspectives	The Quesnel, British Columbia Air Quality Roundtable is implementing a consensus based airshed management plan based on results of a comprehensive air quality assessment completed by the BC Ministry of Environment.

Table 1. *Cont.*

Case Study	Case Summary
Banking Community Assets	Local models for community based economic development are starting to emerge. BCA, is one such initiative, a community venture finance group located on Cape Breton Island in Nova Scotia, Canada. It was established in 1989 in response to the community's need for economic development.
Carfree Markets	This study investigates a local sustainable development initiative to establish a pedestrian zone within a Canadian urban community, Kensington—a neighbourhood in Toronto, Ontario
Community Action on Salt Spring Island	This story concerns the efforts of the activist community on Salt Spring Island, British Columbia to protect their sense of place in response to a large land purchase and a subsequent program of extensive logging and land clearance in critical watersheds.
Community Engagement in Whistler2020	This case study examines the key elements of the Whistler2020 (a planning visioning document produced by the Resort Municipality of Whistler, British Columbia) engagement process and analyses the reflections of 14 community leaders representing various sectors on their involvement in the plan.
Farmers' Markets and Local Food Systems	There is a movement towards strengthening the local food system on Vancouver Island, British Columbia. This case study addresses a key component of the local food system: food distribution by local agricultural producers. In particular, it concentrates on farmers' markets, an important aspect of food distribution.
GHG Reduction Recommendations in the Personal Transportation Sector	This study proposed various short, medium and long-term recommendations on how to reduce greenhouse gas emissions in the personal transportation sector. The recommendations were based on information gathered through extensive literature research and interviews selected based on their expertise in the personal transportation field, and consisted of people from government, non-government organizations and educational institutions.
Green Urban Infrastructure Assessment	GUIA is a software tool that provides a process to identify green infrastructure for urban municipalities in Canada.
Maleny	The relationship between social capital and sustainable development is examined focusing on the nature of development in a small community. Maleny is a small town 90 km north of Brisbane, Australia. Formerly a dairy farming area, it underwent a major transformation with an influx of new residents in the 1970's. The study documents a clash between different notions of development in this particular community.
Merritt	This case study examines the relationship between how a community feels about the characteristics of place and social capital. Specifically, it considers the spatial aspects of the small community of Merritt, a rural town located in the Nicola Valley of southern British Columbia, Canada.
Quest Food Exchange	Quest Outreach Society is a Vancouver, British Columbia-based organization that intercepts, processes and then redistributes non-marketable food to social service agencies and others in need in the region.

Table 1. *Cont.*

Case Study	Case Summary
Salmon River Watershed Management Plan	The Salmon River Watershed Management Plan partnership started out as a group of stakeholders with a desire to produce an effective management plan to protect and conserve one of the few remaining watersheds in the Greater Vancouver Regional District in British Columbia that is still able to support productive fish stocks.
Sustainable Community Planning: Comox Valley	This case study explores issues related to planning for rapid population growth and implementing sustainability in community planning for the Comox Valley, British Columbia.
The National Round Table on the Environment and the Economy (NRTEE)	This case study examines the creation of the National Roundtable on the Environment and the Economy, Canada's first national multi-stakeholder process, the challenges it faced and its evolution over time.
Trust for Sustainable Forestry: Cortes Island	This case study describes the creation and the first project of the Trust for Sustainable Forestry, a small not for profit trust created to develop small ecologically sensitive small communities in protected, but working forest environments.
Urban Food Distribution Systems	13 examples of direct marketing methods in the delivery of farm to consumer food distribution.

Community Openness and Trust: Trans-disciplinary partnerships and alliances are a very common aspect of sustainability projects. All the thirty-five case studies involved formal trans-disciplinary partnerships, normally involving the public and either the private sector, and/or civil society groups as well. Private/public partnerships are commonly referred to as P3 or PPP partnerships by governments; see for example Infrastructure Canada's website [43] or the UK's HM Treasury [44]. In terms of vitality this shows that where there is openness and communication flows rather than hostility between sectors the community is one that foster innovation and creativity. This is demonstrated, for example, in the case of Deep Water Cooling in Toronto, where a public private partnership enabled the co-operation and investment required for the project—the cooperation of multiple private sector organizations with the City provided the necessary economies of scale that made the cooling infrastructure a sensible investment, and the energy and cost savings sufficiently short to make economic sense. In the case of the EnerGuide for Houses in Nova Scotia the loss of federal support proved a significant problem to the long-term maintenance of the project, with the lack of federal grants to householders to support energy efficiency retrofitting meaning householders lacked incentive to examine their home's energy efficiency and possible retrofitting opportunities.

In the case of the Salmon River Watershed management plan failure to produce a robust management plan was, in part, attributed to the souring of relationships between stakeholders due to perceptions of vested interests and hidden agendas—directly impacting trust between parties. Thirty-two of the case studies exhibited facets of trust (or the lack thereof) that directly impacted the full realization of sustainable development in these various contexts.

Connection with People and Place: through a sense of the meaning of the place within the community, for example, the case of Salt Spring Island, Vancouver, British Columbia stimulates community attitudes and values to development that keeps the ecology as the basis of community

action—either explicitly on Salt Spring Island in that a threat to the watersheds initiated very strong community response, or as in Okotoks, Alberta, where a proactive response to the possibility of future over-consumption of a natural resource (access to water) stimulated action. This could be seen as both utilitarian and duty-based ethical philosophies that both serve to initiate place-based community action. Planning initiatives in the Vancouver case study were almost entirely instigated by a desire to preserve access to key landscape features and the city, which has contributed to the ecological and social vitality of this city, now billed as one of the most liveable cities on the planet. Where the relationship to place is completely urban (for example in the Kensington Market case study in urban Toronto or Downtown Eastside in urban Vancouver, case studies), the connection to place tends to be not with the built environment, but to the people and social capital in the specific locale, and is manifest by the generation of networks of empowerment. In the United We Can case study it is connection through the empowerment of marginalized individuals through new network formation, and in Kensington, the creation of community identity with the market. All the case studies involved some connection to either community (69%), or natural place (51%), with fourteen case studies (40%) having both characteristics.

Continuity and Stability: Both stable leadership and stable funding are important in the case studies. In the EcoPerth case study, the leadership of the project was consistent and stable—at the same time the initiative engaged a diversity of people from the community, and was open to many influences. In the case of Kensington market, continuity of funding was identified as key in protecting the leadership from the constant stress of fund raising and therefore from burnout—this in turn allowed for stability of leadership as the core group was maintained, often solely lacking in civil society organizations, especially grass-roots and smaller groups. This stability in many ways contributed to the freedom that these projects had to engage with a greater diversity within (bonding social capital) and in some cases, outside the community (linking social capital), thus enhancing community vitality which built over the life of the project expanding the response from a climate change project to a broader program of sustainable development initiatives at the local level. This maintained community vitality in contrast to the experience of the Dockside Green case study in Victoria, British Columbia, where the municipal leadership individual within the city planning department that first supported the project left, and the knowledge lost meant that the project had reduced opportunities for integrating the ecological and particularly, the social imperatives. The loss of funding in the Nova Scotia EnerGuide program also affected the stability of the project and therefore its contribution to sustainable development when Federal funding was cancelled.

A balance between continuity and openness, therefore, appears to be an essential link to vitality. Security and stability of leadership, and partnerships, particularly private/public, enlarges the public sphere to pursue innovation and creativity. We believe both of these variables are directly linked to community vitality.

A lack of stability of population can also lead to barriers to community vitality. Cities with rapid growth or rapid turnover of population often struggle to create the stability that stimulates vitality. This is very apparent in the case of Wood Buffalo (Fort McMurray), Alberta where economic and social change has been so great that it has inhibited adequate forward planning, creating social and economic instability. This is not necessarily a function of the tar sands extraction per se, but the inability of a rapidly growing (unstable) population to create a shared vision of community. A less extreme example

of this rapid population growth causing problems at the community scale can also be seen in the analysis of community planning in the Comox Valley of British Columbia where the fluid and frequently changing composition of municipal councils led to a loss of vision and inability to put in place robust and long-term planning policy.

Perturbation: Many of the case studies commenced or were instigated after a period of change, or perturbation to the status quo—the perturbation in these cases stimulated the innovation and creativity leading to the community action, notable examples from the case studies include the case examining community action on Salt Spring Island, where the change in management of critical ecosystems on the island stimulated the community response. Direct Marketing of food is a response to the decline of small farming and increasing barriers for small farmers to access markets. Also many of the cases, particularly the renewable energy and municipal planning related ones were responses to change—either locally through population increase for example as in Comox and Okotoks, or in a wider context with local responses to global climate change as in the case of Perth, Ontario and the various alternative energy projects examined.. It should be noted, however, that in many situations of perturbation, especially single-resource economy communities, where the economy changes, communities collapse—this is a phenomenon that the case studies did not examine. The research team will have to re-examine its criteria for case study selection to determine if a bias existed for success, and many research questions flow from this meta-analysis finding, outside the scope of this paper.

It is indeed plausible that given the work of C.S. Holling and the Resilience Alliance (http://www.resalliance.org/) that perturbation is necessary for the maintenance of vitality, with the absence of perturbation leading to stagnation. As the Holling model suggests, moving from exploitation to conservation to renewal to release is the structure of ecosystem functioning. Dale, however, has noted that in human activity systems, especially governments, the pattern is 'stuck' in oscillating between exploitation and conservation, with very little release and no renewal [45]. Again, the meta-case analysis has revealed a discrepancy, in that all the case studies which examined some aspect of governance, planning, or the adoption of technological solutions, show innovative and creative re-organization of some type. This reorganization is apparent at the Federal level with the case of the NRTEE, Canada's first national multi-stakeholder process, in response to the Brundtland Commission report. At the more local or regional level, many of the cases involved the creation of new trans-disciplinary stakeholder groups, for example in Quesnel, Salmon River, Merritt and Whistler. Adoption of new bylaws or policy was also evident to facilitate sustainable development—particularly in the creation of new zoning types on Cortes Island to allow 'ecovillage' style development or the creation of limits to growth in communities such as Okotoks and Whistler to protect the natural resource base. The antecedents need to be further explored.

This finding, that is, perturbation, apparently contradicts the outcome that stability is also important and that too much change, as in Fort McMurray, inhibits vitality. Similarly, there may be a link between the degree in which a community can respond to change and its functional social diversity—assuming that social diversity is analogous to functional ecological diversity defined as "the range and value of those species and organismal traits that influence ecosystem functioning" [46]. Broadly speaking, the more complex and diverse a system is in terms of the functional groups it contains, then the greater degree of functionality it manifests—greater functional diversity leads to

greater stability of the ecosystem, although this may be at the expense of the stability of the abundance of individual species within the ecosystem.

If the perturbation, however, is happening in a way that maintains core stability then it actually stimulates vitality. For example, in Maleny, Australia, the threat of development on valued open land in the community led to a collective vision in a previously divided community between outsiders and long-term residents, with the resultant campaign bringing newcomers and the core community together, an example of the creation of greater community vitality as a result of a perturbation. It may be that community vitality is related to degree of community cohesion, and there may also be an integral relationship between adaptive governance, stability and community vitality that will be explored further in the next five-year research program.

The community response in Salt Spring Island, Canada, arose from a major threat to key watersheds and a change in land ownership, mobilizing the community existing social capital, stimulating the development of greater bridging social capital between disparate networks. Similarly, the BCA program in Nova Scotia was a response to economic under development and the threat of outmigration, which led to the development of enhanced community vitality through economic diversification through co-operative ventures within the community.

It seems clear that a perturbation is needed to stimulate action, and in some cases, vitality, which may be the explanation for why many municipal governments only react to change and do not very often, predict and anticipate change [47], a too stable status quo decreases vitality. It appears as if communities need the change, or the exogenous shock, to 'loosen' innovation and creativity, which in turn stimulates vitality. This is analogous to Holling's creative destruction or release leading to renewal. The changes are necessary, and the clue is to build redundancy at the local level and resilience to buffer especially exogenous shocks, so the change is not catastrophic. This supports the importance of both variables as necessary for sustainable community development as the change contributes to enhanced vitality, assuming vitality and sustainable development themselves are linked.

Although 42% of the case studies can be directly attributable to stimulation from a perturbation, they are disproportionately grass roots or small community case studies. It seems that internal (community or institutional) capacity and, likely diversity of networks and resources, increases the capacity of creative and innovative action and thought. Again, referring to Holling's work, rigidity of institutional and community responses may be more likely in larger scale than smaller communities, similarly, the capacity of what we have defined as adaptive governance in the next five-year research program. Perhaps, this increased capacity to respond, as a function of size, increases the ability to more quickly perceive larger and wider scale perturbations and how this may impact or contribute to greater community diversification. An interesting question to explore will be to determine whether projects instigated by institutions contribute to community vitality in the same ways as grassroots projects, and to what extent scale (the relative proportion between community population and people involved in the project) and connectivity (the density and centrality of networks between the wider community and those involved in the project) contributes to enhance community vitality.

Diversity: All of the above suggests that diversity is also the (or at least one) of the basic components of community vitality, as it is for sustainable development [27]. Community openness enables and facilitates the trans-disciplinary co-operation needed to implement sustainable development solutions, and the incorporation into the dialogue around such projects ensures a variety

and complexity only achieved through the innovation of socially diverse groups. The Salt Spring Island campaign particularly illustrates this, with the involvement of community activists, provincial organizations, the private, public and community sectors, rich well connected benefactors and low wages frontline protestors. However, some degree of more than normal diversity of interactions seems to be apparent in all the case studies. Broader and denser degrees of human-human connection as well as human-ecology connection increase the diversity of relationship within a community, and the broadening of the concept of community to include ecological relationships, necessary for sustainable development, but also perhaps for vitality. This may become increasingly important if, as commentators such as Kunstler and Rubin predict, peak oil means economies become more localized.

6. Conclusions

The most common characteristic of the these case studies that represent the first phase of our research is that all of the thirty-five case studies demonstrate evidence of partnership of one form or another. Given the complexity of implementing sustainable development, its cross-sectoral, interdisciplinary aspects and its cross-jurisdictional institutional focus, this is perhaps to be expected. Moreover, resilience theory suggests that key system components, and the focal scales at which they interact, are often best identified through strategies that partner experts with stakeholders who understand the system from different scales and perspectives [48]. Community vitality in the form of the willingness and agency to form partnerships is a key element of successful sustainable development.

In addition, there appear to be key relationships between partnerships and the ability to innovate. Since partnerships and strategic alliance can reduce the risks of innovation and the uncertainty surrounding the early take-up of new technologies, it would appear to be a strategic advantage to such relationships. As well, social capital and network formation appear in many of the case studies as a key characteristic which is also linked to the diffusion of innovation, since most people decide to adopt an innovation "primarily on subjective values and social norms diffused through interpersonal networks, rather than as a result of rational reflection on scientific data" [49-52].

Our work over the last five years has demonstrated that the community scale acts as an important locus of sustainable development diffusion. Community vitality both provides the needed resilience to weather social, economic, and environmental change, and also provides a site for innovation where problems can be addressed iteratively with a process-based approach through the active engagement of diverse social actors. Community vitality, however, has been badly damaged in the industrial world by the suburbanization of the second half of the twentieth century. Trans-disciplinary dialogue that builds on the need for openness and increased trust within communities, both place based and virtual, may assist in revitalizing community, but our research shows barriers to the collective solving of difficult issues on-line still persist [53]. Increasing community vitality may prove to be a strategic policy direction for governments in the process of sustainable development and a natural bridge between individual action and action at the international and national scale. Further research is required to concretize community vitality as distinct from resilience and sustainable development.

Acknowledgements

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