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Procedures and Responsibilities Involved in the Implementation and Sustainability of a System of Innovation
Commendations

Without getting long-winded or sounding like I am accepting an award, I would like to write a few words about the people who inspired this thesis.

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Abstract

The purpose of this study is to reach conclusions that pertain to the key steps involved in the development of a system of innovation. Once identifiable procedures have been reached, then the research seeks to address the characteristics, or roles, that the actors must adhere to in order to keep the system sustainable. When these two areas of research have been concluded, not only will the research question be addressed, but the general applicability of the system of innovation theories will also be challenged in a scientifically relevant way. The main theoretical concepts that will guide the study are Triple Helix, Sustainability, and Innovation.

The research approach used is deductive, where the information gathered will deem the study as being qualitative. In order to gather the information, six interviews were conducted with various individuals representing actors within the Triple Helix model, and that information was analyzed through interpretism. Due to the social relations occurring in the study, a hermeneutic positioning will derive an underlying positioning in the approach to theory. Once this approach is used, the empirical information gathered from the interviews will be analyzed versus that of the theoretical framework where the conclusions for the study will be generated.

The practical issue that inspired this study is the Mountain Pine Beetle epidemic occurring in British Columbia, Canada. The timber industry is being decimated due to an increase in the number of beetles, and the result is unusable wood. Because of the resource-reliance in certain milieus that are being effected by the beetle, this study seeks an alternative system for economic stability through a system of innovation.

The conclusions for the study have very pragmatic characteristics about them. The development of an innovation system begins with the identification of a system leader to mediate the process. The findings suggest that mediation will harmonize the agendas of the actors in the system and work towards a consensus. In addition, contextual issues in the form of knowledge and communication create cultural roadblocks in the implementation process; therefore need to be overcome in order to divert the actors from strict resource dependency. Sustainability in this system involves exclusive responsibilities between the actors involved, but the fundamental challenge rests in routinization of the process. Routinization encompasses micro-level procedures each actor must adhere to, and once this challenge has been overcome, the innovation system will remain sustained.
1 INTRODUCTION ................................................................. 1
  1.1 BACKGROUND ............................................................ 1
  1.1.1 The Problems with Growth ...................................... 1
  1.1.2 Panarchy ................................................................. 2
  1.1.3 Sustainable Systems ............................................... 2
  1.1.4 Problem Background ............................................. 3
  1.2 INNOVATION SYSTEMS .............................................. 3
  1.3 TRIPLE HELIX ........................................................... 3
  1.4 RESEARCH QUESTION .............................................. 4
  1.5 PURPOSE OF THE STUDY ........................................... 4
  1.6 KEY CONCEPTS ........................................................ 4

2 THEORETICAL METHODOLOGY ....................................... 5
  2.1 CHOICE OF SUBJECT .................................................. 5
  2.2 THEORETICAL PRECONCEPTIONS ................................. 5
  2.3 PERSPECTIVE OF THE STUDY ...................................... 5
  2.4 THEORY OF KNOWLEDGE .......................................... 6
  2.5 SCIENTIFIC APPROACH ............................................ 7
  2.6 CHOICE OF THEORIES .............................................. 7
  2.7 COLLECTION OF THEORIES AND SECONDARY SOURCES 7
  2.8 CRITICISMS OF SECONDARY SOURCES ....................... 8
  2.9 CHOICE OF RESEARCH METHODS ............................... 8

3 LITERATURE REVIEW ...................................................... 10
  3.1 THEORY SELECTION ................................................ 10
  3.1.1 Motivation from Ecology ....................................... 10
  3.1.2 Relevance to the Problem ..................................... 10
  3.2 INNOVATION AND SUSTAINABILITY ......................... 11
    3.2.1 Sustainability Defined ....................................... 11
    3.2.2 Measuring Sustainability .................................... 12
    3.2.3 Innovation Defined .......................................... 13
  3.3 EXAMPLES OF REGIONAL INNOVATION SYSTEMS ......... 14
    3.3.1 Example One – Biofuel Region ............................ 14
    3.3.2 Example Two – Route 128 .................................. 15
  3.4 THE TRIPLE HELIX MODEL ....................................... 16
    3.4.1 Defining the Actors .......................................... 17
    3.4.2 Development of the Triple Helix ......................... 18
    3.4.3 Regional Networking ........................................ 19
  3.5 DIMENSIONS OF THE TRIPLE HELIX ......................... 19
    3.5.1 Knowledge Flows ............................................ 20
    3.5.2 Contextual Knowledge and Codified Knowledge .... 20
    3.5.3 Linear Knowledge Flows ................................... 21
    3.5.4 Endless Transition .......................................... 22
    3.5.5 Push & Pull Factors ........................................ 22
      3.5.5.1 Government’s Role ..................................... 23
      3.5.5.2 Industry’s Role ......................................... 24
      3.5.5.3 Academia’s Role ........................................ 25
  3.6 CONCLUDING REMARKS ON THE LITERATURE REVIEW 26

4 PRACTICAL CONSIDERATIONS ....................................... 27
  4.1 BACKGROUND ........................................................ 27
  4.2 ENVIRONMENTAL CHANGE ....................................... 27
  4.3 THE MOUNTAIN PINE BEETLE .................................. 27
  4.4 THE CARIBOO REGION ............................................. 28
  4.5 THE ROLE OF INNOVATION IN ENVIRONMENTAL CHANGE 28
  4.6 CONCLUDING REMARKS ON PRACTICAL CONSIDERATIONS 29

5 PRACTICAL METHODOLOGY ........................................... 30
6 EMPIRICAL RESULTS ................................................................. 44

6.1 EMPIRICAL APPROACH ....................................................... 44
6.2 UNIVERSITY INFORMATION REVIEW ................................. 44

6.2.1 The Economy .............................................................. 44
6.2.2 Innovation ................................................................. 45
6.2.3 Incorporating Change .................................................. 46
6.2.4 Harmonizing the Agendas .......................................... 47
6.2.5 University Summary .................................................. 49

6.3 GOVERNMENT INFORMATION REVIEW ............................ 49

6.3.1 Economy ................................................................. 49
6.3.2 Innovation ............................................................... 50
6.3.3 Sustainability ........................................................... 51
6.3.4 Cooperation .............................................................. 51
6.3.5 Transitioning Away From Resources ........................... 52
6.3.6 Government Summary ................................................ 53

6.4 INDUSTRY INFORMATION REVIEW .................................. 54

6.4.1 Economy ................................................................. 54
6.4.2 Innovation ............................................................... 54
6.4.3 Cooperation .............................................................. 55
6.4.4 Sustainability ........................................................... 56
6.4.5 Industry Summary ..................................................... 57

7 INFORMATION ANALYSIS AND DISCUSSION ...................... 58

7.1 APPROACH TO ANALYSIS AND DISCUSSION .................... 58
7.2 ECONOMY ........................................................................ 58
7.3 INNOVATION ..................................................................... 60
7.4 SUSTAINABILITY ............................................................. 61
7.5 KNOWLEDGE FLOWS ..................................................... 64
7.6 ENDLESS TRANSITION .................................................... 65
7.7 PUSH AND PULL FACTORS ............................................. 66

7.7.1 Academia ................................................................. 66
7.7.2 Government .............................................................. 67
7.7.3 Industry ................................................................. 67

8 CONCLUSIONS ................................................................. 69

8.1 RESEARCH QUESTION REVIEW ........................................ 69
8.2 DEVELOPING A SYSTEM OF INNOVATION ...................... 69

8.2.1 Identifying a System Leader ......................................... 69
8.2.2 Developing a consensus amongst the actors .................. 69
8.2.3 Overcoming Cultural Roadblocks ............................... 69
8.2.4 System Implementation Review ................................... 70

8.3 SECURING THE SUSTAINABILITY OF THE SYSTEM ............ 70

8.3.1 Government Responsibility ......................................... 70
8.3.2 Industry Responsibility ............................................... 71
8.3.3 University Responsibility ............................................ 71
8.3.4 Mediators Responsibility ........................................... 71
8.3.5 System Sustainability Review ...................................... 72
## 9 CONTRIBUTION TO THEORY

- **9.1 MEDIATOR AS AN ACTOR** .......................... 73
- **9.2 TANGIBLE ROLES** ........................................... 73
- **9.3 MEASURABLE STAGES IN DEVELOPMENT** .......................... 74

## 10 FURTHER RESEARCH

- **10.1 CASE STUDY** .................................................. 75
- **10.2 THE MEDIATOR’S ROLE** ..................................... 75
- **10.3 THE ACTORS PUSH AND PULL FACTORS** ............... 75

## 11 TRUTH CRITERIA

- **11.1 APPROACH TO TRUTH VALIDATION** .................... 76
- **11.2 TRUSTWORTHINESS** ......................................... 76
  - **11.2.1 Credibility** .................................................. 76
  - **11.2.2 Transferability** ............................................. 76
  - **11.2.3 Dependability** ............................................. 76
  - **11.2.4 Confirmability** ............................................. 76
- **11.3 AUTHENTICITY** .................................................. 77
  - **11.3.1 Fairness** .................................................. 77
  - **11.3.2 Ontological Authenticity** ................................. 77
  - **11.3.3 Educative Authenticity** ................................... 77
  - **11.3.4 Catalytic Authenticity** ................................... 77
  - **11.3.5 Tactical Authenticity** ................................... 77
- **11.4 CONCLUDING CRITIQUES** .................................. 77

## RESOURCES

- **Interviews** ................................................................. 82

## APPENDICES

- **Interview Guide** ............................................................. 83
- **University Alternation** ................................................... 84
- **Industry Alternation** ......................................................... 84
- **Government Alteration** .................................................... 85
Figures

Figure 1 Christensen (2005), ‘Real’ & ‘Social’ Dimensions in Collaborative Action.................15
Figure 2 Etzkowitz & Leydesdorff (2000), Estatic Helix Model............................................16
Figure 3 Etzkowitz & Leydesdorff (2000), Laissez-Faire Helix Model.................................17
Figure 4 Allan Cole Roberts (2007), Cross-Collaboration Helix Model.................................17
Figure 5 Allan Cole Roberts (2007), Static Helix Model.....................................................22
Figure 6 Allan Cole Roberts (2007), Actors Inputs & Outputs Effecting the Helix.................26
Figure 7 Allan Cole Roberts (2007), Mediator Incorporated Into The Helix.........................73

Tables

Table 1 Allan Cole Roberts (2007), Interviewee Summary....................................................41
Table 2 Allan Cole Roberts (2007), University Information Summary..................................49
Table 3 Allan Cole Roberts (2007), Government Information Summary.............................53
Table 4 Allan Cole Roberts (2007), Industry Information Summary....................................57
Table 5 Allan Cole Roberts (2007), System Implementation Summary...............................70
Table 6 Allan Cole Roberts (2007), System Sustainability Summary....................................72
1 INTRODUCTION

The purpose of this introduction chapter is to narrow the main problem this study is challenging down so that the reader will understand the practical and theoretical issues. This will lay the foundation for the remainder of the thesis from which the reader can continue with a firm grasp of the topics at hand.

1.1 Background

Modern society has been introduced to a couple of codependent realities: our expectations are virtually always running ahead of opportunities, and mankind has an uncanny ability to create solutions at a rate far slower then our ability to create problems. One main reason for this dichotomy is mankind’s relationship with growth. The result of this equation is a world where the systems we infuse with the expectation of growth fail, and when they fail, the efforts that should have been used for maintenance are increased tenfold for recovery efforts, if the loss of the resource is recoverable at all. With that in mind, this thesis will explore what recovery measures are manageable in a system that has failed, and whether there exists a possibility for recovery through alternate systems.

1.1.1 The Problems with Growth

History has developed a one-dimensional belief within humans which states that growth is, simply put, healthy. The mentality to maintain growth is seemingly instilled in the minds of the majority of the world, and this determined mindset is certainly a cultural characteristic in the Western world. However, this fixation on growth has not come without altering the natural course of systems in the world. Within these systems is a point of equilibrium that, when shaken due to the growth imperative psychology, can result in cascading results that effect other systems along the way (Tainter 1998). So cultivating within this fixation of growth is the reality that society’s pursuit of hyper-growth has a collocating effect on the systems that exist within humanity.

The collocating effect is also known as the growth of concatenating problems (Tainter 1998), and those concatenating problems work almost oxymoronically as applied to the systems of the world. To explain this, look at the systems within the world that are both growing and developing into concatenating dilemmas: terrorism, faltering economics, energy acquisitions (included could be the dilemma of energy returns on investments), diseases, and the environmental crisis. The reality of these issues is that as the connectivity between these systems increase (as witnessed with globalization), so does the complexity, and that added complexity increases the economic commitment needed to remedy the problem. Therefore, this vicious cycle of “growth commitment also increases the problems that come with it” (Tainter 2004, p 36).

The increased economies of scale involved with concatenating problems have resulted in the problem that this paper will research. The growth fixation that started during the industrial revolution and has been the cornerstone of the 20th century has increased all systems of humanity: populations have increased, economies and income levels have increased and technology systems have increased. But with these increases, the growth has obliterated the environment in a plethora of ways. The research supporting the fact that the environmental impact humans have had during this pursuit of growth over the past 100 years has created diminishing returns on resources due to climate change, and these diminishing returns do not appear to be slowing in environmentally dependant economies. These diminishing returns are the main problem that is involved in this papers problem, and the effect the human infatuation with growth has had on the environmental one is the main source of the problem.
1.1.2 **Panarchy**

So there are interesting things to be learnt about the importance of growth and systems and that is they contain cycles. To explain this, take forests for example. Environmentally dependent economies need to maintain their natural resources in order for their economy to thrive. In this example, protecting the forest from disasters such as fires will ensure that the wood can be exhausted for financial benefits in the short term, and the economic system will grow.

But what about the forestry system itself and the natural cycle that is being disturbed in this prevention process? In attempting to extend the life cycle of the forest, the concatenating effect is seen in the increased risk of a far greater disaster the further the system extends itself from the end of its natural cycle (Holling 2001). If a number of small forest fires are repeatedly prevented over the years, then the one massive fire that will ensue from the build-up of the ecosystem will raise the question: Were short-term economic benefits worth the disturbance felt by the environment?

This question has a direct connection to the panarchy theory that studies the relationship between mankind and their environment (Gunderson & Holling 2001; Holling 2001). Within this study, conclusions support the notion that indeed the ecosystems have cycles that are altered by humans, and these alterations result in diminishing economic returns in the long run, rather than the growth benefits that are desired (Gunderson & Holling 2001). This effect of panarchy holds characteristics similar to those of concatenating problems: in efforts to preserve and maintain environmental stability, catastrophe may overtake stability and be the undesirable reality.

Essentially, this is what is happening with the global ecosystem. The Band-Aid solutions over time have allowed for industrial and economic growth by extending the various aspects of the earth’s natural growth cycle, but the result is much like those small fires that were avoided: eventually the ensuing environmental disaster will be far, far larger. This relationship between the natural cycles of ecosystems and the society working within these systems is becoming damaged in the pursuit of economical growth (Gunderson & Holling 2001), and the results are clear as day. As a result, the effects are being felt at a much higher rate, and the concatenating problems associated with this growth infatuation are currently impacting the world at an increasing and horrendous pace, and the complexity involved in finding solutions becomes extremely costly.

1.1.3 **Sustainable Systems**

The intention behind addressing the panarchy theory and concatenating problems is the roots that they have embedded with the underlying themes in this study. Innovation systems work much in the same manner as ecosystems in that they need to have positive and negative inputs in order to maintain a state of equilibrium. This static behavior results in a constant flow of ideas and solutions, and these solutions can affect the systems in the milieu they exist in. If an innovation system is striving to achieve environmental solutions that deliver economic benefits, then sustaining this behavior is important in order to have a dynamic setting that is moving forward and not suffering.

In order to have this sustained behavior, its important to deliver answers to the first two downfalls that were addressed in this introduction. Is it possible for innovation to create the opportunities that our expectations desire? Can innovation reduce the problems we are creating so that society is left with a surplus of solutions? Parts of the answers to these questions will be answered in this paper, and once they have been answered, the role of sustainability will be increased in order to maintain a state of equilibrium within the system.
1.1.4 Problem Background

As mentioned earlier, the damage done to the environment by humans over the past century has been momentous. The most noticeable result has been the increased temperature of the globe, and this has caused a plethora of change. The details involved in these changes will be penetrated further in chapter four, but the specific change that this problem is dealing with is quite clear.

The mountain pine beetle has decimated the forest industry in western North America, and communities both large and small have felt the economic decline. Essentially, the beetle deems infected wood useless, and when that wood is the heartbeat of the economy, then where are the economic solutions coming from to fill the void?

Narrowing the problem down further, the Cariboo\(^1\) region in British Columbia\(^2\), Canada has felt the effects of the epidemic the most out of any region in North America, and the threat of the pine timber being completely extinct within 25 years is a harsh reality. Again, chapter four will outline the specifics of the problem and the effects felt by towns in that region.

Concatenating problems have caused this dilemma that the Cariboo is now facing, but maybe concatenating effects do not always have to be negative. The thirst for growth has caused global neglect for the environment, and the faltering environment is now having its revenge. The revenge is being felt in the form of natural resources being exhausted or altered to the point of being unusable, and now is the time for action. In a region such as the Cariboo, the question that should be asked is whether there can be concatenating solutions generated through innovation, and if so, then no doubt the role of innovation as a system increases greatly. Otherwise, the economy will continue its decline, and eventually communities with timber reliance will be left with nothing.

1.2 Innovation Systems

One reoccurring theme in this research will be systems of innovation and the viability that these systems can possibly assist in creating economic sustainability. The two key elements in the composition of an innovation system are found in what the ‘drivers’ are that inspire the system and the ‘resources’ that support the collective action (Garrett-Jones 2007, p 47). In addition to the pursuing innovation through the assets found in terms of knowledge and resources, innovation systems are often initiated through the demand for knowledge, and at a regional level, this is driven particularly by policy (Garrett-Jones 2007, p 46). As it relates to this study, an innovation system will be queried in a region with a presumed need for innovation, and the key elements that comprise these systems will be analyzed.

1.3 Triple Helix

The innovation system that will be applied in the effected region will be the Triple Helix\(^3\) of innovation. This theory pertains to the notion that collaborative efforts between government, university and industry can spearhead effective changes, while anchoring the longevity of that change in sustainable innovation. The networking amongst these actors is said to encourage the cross fertilization of knowledge and expertise, and if this indeed is a viable alternative for structured change, then perhaps the drastic economic effects of environmental change can be managed through the enhancement of innovation.

\(^1\) The Cariboo is a region located in the Interior of British Columbia. It will be outlined further in chapter four
\(^2\) From this point will be referred to either as ‘BC’ or as British Columbia
\(^3\) Triple Helix will be referred to as either ‘Triple Helix’ or simply ‘helix’ from this point. For readability sake, this is the champion theory used in the thesis, and will be explained in greater detail in chapter three.
1.4 Research Question

How can a system of innovation be developed within an environmentally changing region, and what can the actors within this system do to secure its sustainability?

1.5 Purpose of the Study

The purpose of this study is to reach conclusions that pertain to the key steps involved in the development of a system of innovation. Within those key proceedings, the specific elements that comprise the steps will bring functionality to the practical application of such a theory. Once identifiable procedures have been reached, then the research seeks to address the characteristics, or roles, that the actors must adhere to in order to keep the system sustainable. When these two areas of research have been concluded, not only will the research question be addressed, but the general applicability of the system of innovation theories will also be challenged in a scientifically relevant way.

An additional, and far more practical, purpose for the study is to generate a thesis that will be applicable within any environmentally changing region that wish to look to innovation for economic stability. Whether it is government, industry or university, the secondary purpose of this paper is to bring relevance to systems of innovation, and enhance the viability of actually applying this in a relevant milieu.

1.6 Key Concepts

- Triple Helix
- Innovation
- Sustainability

These concepts will be clearly defined in chapter four.
2 THEORETICAL METHODOLOGY

After reading this chapter, the reader will understand where the motivations for the problem have come from and the implications this has on the methodological process of the report. In addition, a more in-depth understanding of the literature selection and application will develop.

2.1 Choice of Subject

Coming from a background where every hockey tournament, every fund raising event, and every source of economic activity in my hometown was influenced by the logging industry, the thought that it could disintegrate is terrifying. In that light, the decision to use this subject for the focus of study is one way a contribution can be made back to the industry that gave so much to so many in the region I come from. Understanding that the people involved in creating solutions for the future of the region can take this report and use it as a tool for bettering the economy is a motivating factor for this study. In addition, the contributions that academia can make to industry is obvious, but a deficiency in the research conducted in this region calls for action. Because the influence of academia in 100 Mile House\(^4\) is unknown, this proved as another source of inspiration for this study.

While there is a personal connection to the problem, there is also the inclination that other communities may look to entrepreneurship and innovation as a solution for economic turmoil. This field of study offers many solutions for economies, but motivating entrepreneurship, or innovation systems, is not a common outlet that is pursued by decision makers. Therefore, a natural interest has developed in the field of entrepreneurship, and using a personal issue as a springboard for potentially bettering other communities felt like a logical explanation for choosing this subject.

2.2 Theoretical Preconceptions

Innovation systems and their impact on sustainable economies is an area of research that began to interest me due to the effectiveness it has in theory, specifically the helix model. The theories that impacted me the most were the ones that were outlining the issues directly spoken about in the helix discussion; policy making, dynamic business settings, business intelligence, environmental entrepreneurship, et cetera. All these topics laid a foundation of knowledge from which the helix encompassed entirely, and from this foundation, the application of the helix towards regional innovation systems inspired future research into the topic.

Due to the limitations of my previous studies directly into the helix model, this opened the possibilities to explore the subject and develop a more personal opinion from the works of previous scholars. Understanding that only using selected theories leaves room for scientific bias, it was essential to begin exploring all applications of the model in order to fully comprehend where the benefits and downfalls are. From that point, applying my understanding of the model to the problem involved in the study will generate the most applicable results and solutions.

2.3 Perspective of the Study

The dynamics involved in the helix theory demand for a decision to be made in terms of what perspective the problem will be observed from. The helix can be viewed from the perspective of government, academia or industry; therefore researching the problem becomes difficult due to the challenge in offering a conclusion applicable for all parties.

\(^4\) 100 Mile House is located in the Cariboo region of British Columbia, Canada. This will be outlined further in chapter four.
To outline this variance in perspective, it is necessary to bring up Etzkowitz (2002) and the bias he appears to have towards applying the theory of the helix from an academia perspective. Etzkowitz’s (2002) approach is not completely negative towards the other actors, but it is clear in his conclusions that academia and research provides the premier dynamic when speaking of contributions made to the helix. At the same time, Saad and Zawdie (2005) portray to the reader that the conclusions of their study of the helix in Algeria would be viewed most favorable from the perspective of government. Again, this not negative, but it is important to address that the helix offers room for varying the perspective from which the author works.

For the sake of this study, the helix will be viewed as a whole unit from which contributions to innovation are made when the actors are in equilibrium. However, in terms of the conclusions, particular attention will be given to industry perspective due to the regions reliance on a healthy industry. The favor-ability industry garners are also a result of the research objectives this study is working for, because a sustainable economy must have a thriving industry. Using the viewpoint of the industry in the conclusions will enable this report to be used by industry when working with academia and government, and if the representatives of industry in the region choose to pursue change independently, the results of this report may contribute to their decisions.

From a theoretical level, the perspective of this study will use sustainability as the primary driver. All the theories encompassed direct the underlining purpose of the paper towards that of a sustainable system, so achieving that will be the main point of view. The inspiration to research into an area of sustainability came from reading a plethora of works such as that novels on sustainability from authors such as Homer-Dixon (2002, 2006), and being exposed to the nonstop flow of information on the subject in everything from newspaper to documentaries. Sustainability has become a bit of an enigma in terms of achieving the perfect model, and it may never truly be developed. However, the reality is that this is not simply a buzz term in the fight against the changing forces of nature, but a fixture in humanity that will not be taken for granted.

2.4 Theory of Knowledge

There is an additional underlining theme involved in this study, and that is the interactions of actors in their environment, and how their interactions make contributions to the betterment of that environment. This approach is in accordance with the hermeneutic-phenomenology position this study will adhere to, which is embedded in “the philosophy that is concerned with the question of how individuals make sense of the world around them” (Bryman & Bell 2003, p 16). A hermeneutic positioning for this study is necessary in order to interpret the social relations that are occurring between the actors in the region, and draw predictions based on their interactions. Positivism, and its reflection of a natural order in humanity (Bryman & Bell 2003), would not be applicable in this study for many reasons, but primarily because of the static nature of the problem and the call for action. An objective view, as suggested by positivism, would not serve justice to this study; therefore calling on hermeneutics interpretation of human actions (Bryman & Bell 2003) is the only feasible position. The ability to interpret what is occurring, to understand those occurrences and strive towards effective conclusions will be the approach taken in the research, and these are strikingly obvious characteristics of hermeneutic studies.

The traditional affiliation between positivism and qualitative information-collection will be averted in this study due to the call for interpretism. Combining hermeneutics and qualitative methods will allow for a better application of the social forces involved in the problem, and understanding this fact is related to the fact that a positivist approach would impede the research because of it is rigidity. Where positivism has roots in laws and scientific truths (Bryman & Bell 2003, p 14), interpretism calls for social and environmental understanding, and this interpretism
will benefit the region much more effectively over time. In that essence, quantitative data collection will not benefit the study because this problem will be solved through generalizations, not strict scientific statements, which will be supplied through a process of qualitative information collection.

2.5 Scientific Approach

The nature of the research in this paper is clearly guided by the theories of innovation systems and the value they can add to a regional economy if sustained. Because the conclusion of the research will falsify or verify the arguments of a specific innovation system, the helix, the approach of the study will be deductive. Empirical scrutiny and logical reasoning will be generated through the studies, and the theories of the helix will be tested. These characteristics encompass exactly what a deduction approach would be (Ghauri & Grønhaug 2002, Bryman & Bell 2002), and had an inductive strategy been used, it is difficult to envision any useful conclusions being the result of the study. The main reason for this is the nature of induction where “theory is the outcome of research” (Bryman & Bell 2002, p 12), and the problem stated in this study does not call for empirical information working towards a theory. Simply put, induction would make the effected region a testing ground for theoretical conclusions, and that could develop into a vicious cycle of wavering theory while the economy continues to plummet.

2.6 Choice of Theories

In the selection of theories, it is important to address that the evolution of the helix in research has only truly developed in the last decade or so. In that light, the relevance of the conclusions made by other researchers will benefit this study due to the timeliness of their applications and the varying degrees from which they are generated. Theories of innovation systems (outside the realm of the helix) have a plethora of breadth in research; therefore the decision was made to truly focus on the implications of the helix model alone. It would not be a challenge to get carried away in studying the various dimensions of innovation systems, but maintaining the focus on the helix is the intention of the research, and all conclusions reached from this study will have roots in the helix model. Within the applications of the helix model, the choice of theories will also lead this study towards an application of the model from the author's own perspective. The reader will begin to notice this developing perspective in the theory review chapter from which a model of the helix in equilibrium will develop as part of an underlining theme, and then challenged by the empirical information. It is important to develop this independent perspective in order for this study to maintain an air of deduction, because striving towards empirical scrutiny and logical reasoning through practical research is the theoretical driver throughout the paper.

2.7 Collection of Theories and Secondary Sources

The process of gathering scholarly articles and other forms of literature will be done primarily through the use of the meta-search engine available via Umeå University's online library informationbase. The informationbases encompassed through this meta-search engine include Album – Umeå UB, Libris, Academic Search Elite, The Web of Science, and Google Scholar. The process of information collection will grow in an exponential manner when entering keywords into the search engine, but the foundation will be concepts such as triple helix, government-university-industry, helix innovation, sustainability, and so forth.

As will be noticed in the reference section, the decision to only use peer reviewed articles will support the scientific structure that is intended to be developed in this paper, and if the article is not scholarly, it will be noted should further research into the author's credibility be desired.

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5 Using the term ‘information’ will avert ‘data’ due to the fact this is a qualitative study rather than quantitative.
In addition, all attempts to limit the use of Internet websites as sources has been made, but should they be incorporated into the paper, it is important to refer to where they are generated. Government, or state-supported, websites will be viewed as reliable sources for such information as statistics. Generally accepted sourcing procedures such as date accessed will add weight to the reliability of the sites, which will assist doubtful readers in probing further into the sources of information should there be an air of doubt. For all intended purposes though, web sources will be limited to the best of what is researchable through academic articles.

2.8 Criticisms of Secondary Sources

When reading through the theoretical chapter, the works of Etzkowitz and Leydesdorff will be reoccurring themes, and this is justified because of their research being the inertia from which other helix studies were built around. Without their work through the late 1990’s and early 2000’s, the inspiration for the worldwide application of the model is questionable; therefore it is only logical that their theories will be omnipresent throughout this thesis.

One major deficiency noticed in the articles was the relationship to environmental issues. The application of the selected theories creates a very efficient framework for innovation in many industries, but there were noticeable exceptions when speaking of natural resources. In addition to minimal natural resource references, research in this area has failed to develop past the main authors of the subject, Etzkowitz and Leydesdorff, so the vast majority of the articles used in this paper are born from the work of only two individuals. That being said, the articles have applied themselves on a global scale and the plethora of backgrounds from the selected researchers offers this paper much depth in terms of perspectives and interpretations of the helix model.

To go into more depth on the main theory used in this research, the helix, there are noticeable deficiencies in the research. For example, distributing credit for innovation and protective nature of idea generation is underdeveloped, and while this is somewhat contradictory to the premise of the helix, it still should be explored. Another area of research that may alter the results of this thesis due to lack of material is the cultural application and interpretation of this model. While praising the variety of research that is done by the many authors, the reality is the theories they develop may be totally irrelevant for this issue. In that respect, letting their theories guide this thesis will be the approach and the theory proposed in this study will unfold without accordance with other applications. Finally, the theoretical application of the helix failed to deliver practical starting points for the application of the model. It is the hopes that that will be a key contribution with this paper, as the contributions of research in this area should definitely have usability.

2.9 Choice of Research Methods

The intention of this research is to test how an innovation system can be applied to a region where the interactions between the actors of the helix are unknown. In addition, the practical implications of an innovation system in a changing economy will be argued against based on the viewpoints that are portrayed by the actors in the region. In approaching that issue, the method of research will need to penetrate the macro and micro issues involved in the relationships. Understanding the actor’s perspective of themselves and the other actors will generate conclusions that will be verified by the theoretical implications of the helix. From those verifications, the conclusions of this report will be able to offer suggestions and direction, both in theory and in practice, to the region in terms of possible development procedures that can be employed.
More specifically, this research aims to predict the nature of the specific attributes of the actors through qualitative research. Actors within a helix possess specific characteristics that have been verified through research, and these characteristics, when present, create an innovation system that generates economic activity. Therefore, this report will develop an in-depth profile of each of the actors, examine where deficiencies and surpluses are in their cooperation and this information will support or question the helix. The best way to accumulate this information is from the actors themselves; therefore semi-structured interviews with the most appropriate representatives will generate clear and relevant results for this study. Interviews will benefit this study more than any other form of information collection due to the applicability of the information garnered in the interviews towards the characteristically-dependant model of the helix.

It should be noted for the reader that consideration was given to approach this thesis as a case study, due to the specificity of the region used in the empirical information collection. Within case study designs, there is an “intensive analysis of a single case” (Bryman & Bell 2002, p 53), where a singular case could pose as a location, an organization, a person or an event. Often times, case studies entail “detailed exploration of a specific case” (Bryman & Bell 2002, p 32), but the deficiency in this process is seen in the collection of information through empirical method. The purpose of this study is to alleviate the isolation that is associated with specific cases and contribute to theory that has a wider end-user. Without question, case studies can, and often do, contribute similar final conclusions, but the particular scenario dealt with in this paper had more breadth involved then the specific nature required for a case study. In addition, a case study was diverted in order to leave room for further research as inspired from the conclusions of this paper. The contributions that are made in this paper offer solutions and procedures for any region to incorporate innovation into their economy, and the systematic process offered can surely be carried out in a practical milieu. Therefore, using this paper as a springboard for a case study seems like a more logical approach in order to truly falsify or verify the findings of this thesis. The final point to address in regards to case studies, and a motivating factor in the decision to not apply that process to this study, was inspired by Yin (1984). While the case study model can be worked into many different fields of study, generalizing scientific arguments is often the result. Generalizations may provide answers for certain end-users of studies, but seeing as this study is seeking to reach the scientific community, situation-specific conclusions are not acceptable. Yin (1984) does validate the argument that case studies find sufficient audiences in particular milieus, and perhaps this study will accomplish that as well, but the intentions are to draw conclusions for a wider audience then exclusively the region being studied.
3 LITERATURE REVIEW

The objective behind this chapter is to introduce the reader to the literature that will be used to challenge the environmental problem outlined in the introduction. This section will begin with creating a connection between the problem and how the works of previous scholars and researchers may work to create solutions for this issue. By the completion of the chapter, the reader will have a base knowledge of the relevance the theories have to the study and the various applications of the theories.

3.1 Theory Selection

When reviewing the practical problem at hand, there was a glaring deficiency in resiliency in the economic structure of the community. From a theoretical perspective, that left for many possible approaches to fill this void, one being innovation, but before probing the subject, having a more diverse understanding was necessary.

The introduction to this thesis discussed the theories of panarchy and concatenating problems that hinder growth in systems. This is an important point to bring up for this study because these two theories point to the very nature of what systems generally do: they are built up and are static, but all the while have a certain degree of vulnerability within them that can affect their growth. Understanding preventive measures to limit that vulnerability needs to be researched in order to develop a theory that could sustain the growth phase of the system, and inevitably the longevity of it is growth cycle.

3.1.1 Motivation from Ecology

With that motivation in place, the reader should understand that the point of this study was not to get carried away with the growth phenomena or with ecological metaphors. Indeed, growth could be a measurement tool used for future studies on the application of this paper’s findings, and perhaps growth theories could be applied to the practical problem via a case study format.

What should also be understood though is growth does have relevance to innovation as it pertains to a system. The concatenating effects (Tainter 1998) that effect ecology systems will inevitably have similar effects on a system of innovation, although in a more system-specific manner. What is relevant is how resiliency is developed in order to minimized the negative effects of these concatenating issues, and that was a consideration whilst selecting the theories for this chapter.

Similarly, the panarchy theory was used as a reference point for growth in the introduction, but aside from being a platform for resiliency, it was merely an ecological metaphor associated with systems. The relationship between humans and nature is heavily embedded within the panarchy theories (Gunderson & Holling 2001), and because this study pertains to environmental issues caused by humans, it was an appropriate starting point.

Much like resiliency in panarchy, resiliency in innovation systems is necessary to research, and as this chapter develops, these issues will be addressed in more depth.

3.1.2 Relevance to the Problem

The relevance of the selected theories to the practical matter of the beetle kill is found in the model they provide for innovation. The main issue surrounding the effected area (100 Mile House) is great deficiencies in innovative solutions that will support the economy in development. This will be outlined in greater detail in the methodology section, but what is
important to develop is a theoretical base from which innovation can be seen. The selected theories will work towards developing a strategy that can be directly applied to the effected region and the relevance of this strategy will be reflected through the analyses against the empirical findings.

3.2 Innovation and Sustainability

The applicability of innovation towards achieving sustainability has been researched at various levels – ranging from districts to entire cities – and practical applications testing the breadth of sustainable systems are vast. In order to bring relevance to this report, aspects from these numerous reports will be introduced with the primary focus being on their contributions to maintaining a stable economy through innovation. From these contributions, innovation and sustainability will have definitions applied to them that will be used for the remainder of the thesis.

Whilst discussing the importance of sustainability, it is as important to recognize that the reason for doing so is to make a link to innovation. As will be discussed in more depth further into this chapter, innovation is one key element to healthy, progressive economies. But one of the key attributes to sustainability is the element of change, which is one major feature of innovation. The most noticeable connection between sustainability and innovation will be the element of change that is present, and when this element of change occurs between the two variables, the benefits are potentially felt in positive economy change.

For readability sake, it may be beneficial to see the link between sustainability and innovation develop throughout this chapter, and then connect that to how a system of innovation acts as a median for obtaining the desired level of sustainability.

3.2.1 Sustainability Defined

With the plethora of research on sustainable systems (and sustainable development) available, this paper will approach the most relevant definitions from which one will be generated that best suits this thesis. There are undoubtedly exclusions from existing theories in terms of what is the definition of sustainability, but in order to not become side tracked from the original research issues, minimizing the amount of terminology will be the approach.

In that light, the following five definitions are viewed as having the most relevance for this thesis:

Definition One: “What sustainable development essentially does is call for a more effective use of existing resources. This applies to human resources, as well as raw materials and financial capital.” (Karapetrović et al. 2007)

Definition Two: “Sustainability is a consequence of the culture, and is a long-time, systems issue” – John Ehrenfeld (Fortmeyer 2006)

Definition Three: “Sustainable development is leaving sufficient resources for future generations to have a quality life similar to ours” (Brundtland 1987)

Definition Four: “Sustainable economic development is defined as economic development with higher economic benefits and better ecological performance” (Dawson et al 2006)
Definition Five: “Sustainability represents a novel and radical departure from past practice in that for the first time the well being (‘welfare’) of future generations is being brought to the fore as a material consideration” (Tate 1994)

Key Characteristics:

Effective resource allocation, an issue of systems, sufficient resource usage for future generations, develops higher economic benefits, betters ecological performance, departure from past practice (change)

Definition: “Sustainability is a system of change that strives to efficiently and effectively allocate resources and secure a high level of ecological performance in order to secure economical and environmental benefits for both present and future generations” – Allan Cole Roberts 2007

The definitions used encompass various degrees of sustainability, but for this report, there are two dimensions that are the most relevant. First of all, this research aims to verify if sustainable innovation systems can better the economic conditions of a region. If this is possible, the second dimension of sustainability will be the creation of environmental solutions that are possible as a result of this sustainable innovation. Therefore, there are two elements of sustainability in this report: sustainable innovation systems and sustainable economic conditions.

Parris (2003) made a very important observation in his study on sustainable transitions and inspired this situation specific application of sustainability. Parris stated that when “defining sustainability, (it) requires a clearly articulated consensus on what to develop, what to sustain and for how long” (Parris 2003, p 2). As it applies to the generation of this paper’s definition, it is vital to consider the actors involved, the goal of the research and the problem that exists. That being addressed, Parris’s elaboration that certain definitions of sustainability are situation specific justifies the creation of an exclusive definition for this research.

3.2.2 Measuring Sustainability

As there are three dimensions of inputs in this research study (in the forms of the actors), there are also various dimensions involved in the measuring of sustainability. In order to better understand the vigor of interactions between the actors, the individual level, the organizational level and the regional level will be researched where a prediction for the system’s implementation can be constructed. The inspiration for this form of analysis stemmed from Sheirer’s (2005) conclusions on programs of sustainability and the factors that contribute to sustainability. Sheirer’s contributions to the research of sustainability included “the importance of measuring the following levels involved in a sustainable system”. Included in measuring these levels are the researching of micro level factors that “are vital for a system of sustainability” (Sheirer 2005, p 341).

Both the varying levels and micro factors of measurement of sustainability are listed as follows:

Element One: Continuing to deliver beneficial services (outcomes) to clients (individual form of analysis)

Element Two: Maintaining a program and/or its activities in an identifiable form, even if modified (an organizational level of analysis)
Element Three: Maintaining the capacity of a community to deliver program activities after an initial program created a community coalition or similar structure (community level of analysis)

Element Four: Factors include identifying the guidelines for regional development

Element Five: Identifying those who take the leadership role in regional development

Element Six: Identify if there exists routinizing in the region

Key Characteristics: Deliverance of benefits, maintaining identifiable activities, capacity to deliver, identifiable guidelines, leadership roles, routinizing

While applying measurable guidelines and identifying program leaders will create dependability in the application of a sustainable model, the process, or routinization, more closely relates to innovation, and will be more closely examined in this report.

As identified by Yin (1979), innovation and the application of change to an organization (or innovation system as it relates to this report) eventually becomes “routinized” (Yin 1979), or a routinely visited activity. The argument that Yin makes is that innovation must exist in order for sustainability to be achieved over the long run; therefore the level to which it is institutionalized in a region must be measured (Yin 1979). The role of leadership is heavily integrated in the process of routinization, as it “constitutes a critical success factor in the integration of sustainable development” (Karapetrovic et al. 2007, p 89). The importance of establishing guidelines is also confirmed by introducing objectives in the process of sustainability due to the fact that “objectives… cover several dimensions of performance and use of resources at the macro and micro level” (Karapetrovic et al. 2007, p 85). In the case of this report, the resources are those related to the timber industry, and the focus of the innovation towards sustainability will be the improved use of these resources.

3.2.3 Innovation Defined

Innovation, much like sustainability, has been defined in numerous ways throughout research and theory. Therefore, for applicability’s sake, generating an effective definition will be conducted using the more relevant definitions.

Definition One: “Innovation is the processes of inventing and applying a new idea” (Galbraith 1996)

Definition Two: “Innovation must have economic significance in order to be viable” (Edquist 1997)

Definition Three: “Innovation is related more closely to improving competitiveness and economic success then to simply problem solving” (Nooteboom 2000)

Definition Four: “Innovation is nowadays seen as a socially and territorially embedded process and the regional level is recognized as being the best context for the development of innovation” (Asheim & Isaksen 1997)

Definition Five: “Innovation without entrepreneurship cannot result in regional development” (Feldman & Francis 2004)
Key Characteristics: Inventing and applying a new idea, having economic significance, improving competitiveness, socially and territorially embedded, connected to entrepreneurship

Definition: “Innovation is the creation and application of new ideas or processes that are developed from tacit behavior (at the regional level) and when transferred into entrepreneurial activity, the contributions have economic, competitive and social significance” – Allan Cole Roberts 2007

This will be the working definition for the remainder of the paper, but the research will aim to apply this innovation to a regionally based system of innovation, as opposed to the national level or the level of differing physical proximities. In order for the research to have relevance, a regionally based innovation system must have territorial embeddedness because the innovative capacity of the region will directly affect the sustainability of the economy. The motivation for this region-specific approach stems from Asheim and Isaksen’s (1997) conclusions that “interactive learning as a fundamental aspect of the innovation process provides the ground for an interactive learning model, which is greatly facilitated by geographical proximity” (Asheim & Isaksen 1997, p 317). This localized geographical proximity will be discussed further in the section on tacit knowledge, but for the sake of innovation, it is to be assumed that the most effective application will be generated from a local, or region specific, level.

3.3 Examples of Regional Innovation Systems

Before divulging into the details of the innovation system used in this study, the decision was made to give examples of two distinct forms of regional collaboration. For readers unfamiliar with systems of innovation, these examples can give reference to the general purpose behind regional systems of innovations, and how the initiation of such systems can motivate changes in regional economic conditions.

3.3.1 Example One – Biofuel Region

In the northern Swedish counties of Västernorrland and Västerbotten, the decision was made in 2002 to initiate action to convert the region in a Biofuel Region (BFR). Within this decision was a goal to construct a regional system of innovation between the business world, the public sector and academia where the result would be a shift towards the use of renewable energy, more specifically the conversion of cellulose-based raw materials into energy, with the intention for the region to achieve sustainable economic growth through collective action. The implementation of such a system called for a regional platform from which to work from and from which a strategy to achieve the BFR initiatives.

One example of the platform from which the actors worked from was a model balancing what was ‘real’ in the milieu (the physical resources) and the ‘social dimensions’ (the actors) (Christensen 2005).
Figure 1 Christensen (2005), ‘Real’ & ‘Social’ Dimensions in Collaborative Action

In order to implement such an initiative, the course of action needed prioritization within the region, and the strategic choices were built outwardly from the needs of the actors and the social structures in place. What is important to address in the situation of the BFR is the technology platform that has constructed itself around in terms of both a highly advanced entrepreneurial university, and a regional governing body that is stimulating the process with policy. Naturally, these two dimensions drive a project like this, and the collective behavior and social movement will incorporate the business world far easier when the degree of risk has been alleviated. What the most unique characteristics about this Biofuel initiative, and is a culturally embedded element, is the region itself called for collective action as part of a value-based social movement, and anytime there is social change combined with industrial opportunity, as is happening with the ethanol movement, then the situation is primed for a collective movement such as this (Christensen 2005).

The motivation behind briefly outlining the course of action in the BFR is the implications that it has on the helix model. Essentially what this initiative is doing is driving the pursuit of a new industry in ethanol through the cellulose procedure, and it is the minds of the actors that are driving this. The contributions that this example can make to this thesis are seen in the social demand that is created when a society demands change, and the next question to be asked is can the Cariboo region in Canada initiate the same type of change. All the elements that exist in the BFR are in the milieu of the interior of British Columbia, so perhaps there is a cultural characteristic that drives collaborative action amongst the actors of the helix.

3.3.2 Example Two – Route 128

In order to bring relevance to the helix, display how it achieves innovation, and expose its contributions to regional development, a second example will be used. It is based on the decline of an industry and the rejuvenation of an economy - all through the actions of the helix model.

Early in the 20th century, the helix configuration was applied to the development of Boston’s “Route 128”. While never strictly identified as a helix initiative, this was clearly a collaborative effort between academics, regional developers and politicians in response to the industrial decline of the Massachusetts textile industry in the 1920’s (Koistinen 2000).

In order to rejuvenate their economy which was experiencing industrial decline, three policies were assembled to reverse the decline: (1) ‘Retrenchment’ was promoted in order to decrease business taxes, (2) ‘Economic Development’ was implemented with the hopes to strengthen existing industries and develop new ones and (3) ‘Federal Intervention’ strove to increase the role
of government through federal action and industrial regulations. All three helix actors carried out these initiatives, and the result of the objectives was the development of the world’s first technology cluster in the Massachusetts area. An economy in serious decline was identified, and the actors involved with the helix acted in unison and saved thousands of jobs through knowledge exchange and innovative solutions (Koistinen 2000).

There are many examples of regional development through collaborative efforts such as this, but the point is that induced innovation has created stable economic conditions in the past, and has the potential to continue doing so in the future. Etzkowitz (2002) came to the conclusion that “within specific regional contexts, universities, governments and industry are learning to encourage economic redeployment through the development of loosely coupled reciprocal relationships and joint undertakings”. Within these interdependent relationships is where innovation is born and the helix contributes to regional economic development, but it is ultimately up to the individual actors inside the region whether this collaborative effort occurs or not.

3.4 The Triple Helix Model

In terms of innovation systems, the theoretical framework that will be the inspiration for this study will be that of the Triple Helix which focuses on the transferring of knowledge between three interdependent actors; government, industry and academia. As a result from the works of Etzkowitz and Leydesdorff (1998, 2000), the model proposes that the actors within the helix create a spiral of innovation through their cross-fertilization of knowledge. The model of the helix “denotes the university-government-industry relationship as one of relatively equal, yet interdependent spheres which overlap” (Etzkowitz 2002) and as these actors overlap, the configuration of the helix is formed into three exclusive, distinct configurations. The three configurations have sociological foundations, and this is noticeable in both their contributions to innovation and the varying degrees of interdependency.

Figure two (below) exemplifies the sphere of government, or state, incorporating the roles of academia and industry. Etzkowitz and Leydesdorff (2000) linked this model to that of the former USSR, or socialism, due to the empowerment of the state, which was also known as “an etatistic model of university-government relations” (Etzkowitz & Leydesdorff 2000, p 111).

![Figure 2 Etzkowitz & Leydesdorff (2000), Etatistic Helix Model](image)

Figure three (following page) was compared to the United States ('capitalist') in Etzkowitz’s (2002) second example, due to the separation between the actors, where linkages are through distinct channels of communication and there is a higher level of interdependency in comparison.
with figure one. The description used for the second model was that it is a “laissez-faire model of university-government-industry relations” (Etzkowitz & Leydesdorff 2000, p 111).

Figure 3 Etzkowitz & Leydesdorff (2000), Laissez-Faire Helix Model

Figure four (below) of Etzkowitz and Leydesdorff’s model was a coactive model where equal distribution of knowledge between the actors exists in the helix. The degree to which overlapping knowledge exchange between the actors is the point innovation, and this innovation point is the most distinguishable of the three models. In theories, this model is referred to as “The Triple-Helix Model of university-industry-government relations” (Etzkowitz & Leydesdorff 2000, p 111). The following model was inspired by Etzkowitz and Leydesdorff (2000), but the ‘innovation point’ is a slight alteration from the point of “tri-lateral networks and hybrid organizations” (Etzkowitz & Leydesdorff 2000, p 111).

Figure 4 Allan Cole Roberts (2007), Cross-Collaboration Helix Model

3.4.1 Defining the Actors

While the fundamental basics of the actors within the helix have been addressed, defining who the actors are more specifically will be carried out in the methodology chapter. For the remainder of this chapter though, the reader should maintain the mindset that the actors are represented as follows:

State: Policy makers within a system, generally government or municipal officials. Included in the sphere of state are also rotary representatives and community elected decision-makers who are
strategic planners for a specific region. The title given to these decision makers may be modified, but the function that they carry out in terms of policy and forecasting is the main element to consider whilst defining them. – Allan Cole Roberts, 2007

Academia: The institutional element of the helix comes in the form of university (college) or any other form of research center. The key element of academia is the knowledge and research contributions it makes, and while the title encompassing this center for learning may shift, its main form comes in the shape of a learning institution. – Allan Cole Roberts, 2007

Industry: Industry can be cascaded across numerous specializations ranging anywhere from high-technology industries to environmentally reliant regions, but so much as they have economic activity, the settings may have different characteristics. It is important to remember that industry indeed changes across dynamic business settings, but so long as it has an identifiable pulse within a region, then it is represented effectively within the helix. – Allan Cole Roberts, 2007

3.4.2 Development of the Triple Helix

Etzkowitz and Leydesdorff’s (1998, 2000) pursuit of the helix was a dictation from society’s developing view of the role of science, and the contributions science made to knowledge in society. Specifically, they saw the traditional divide between industry and academia opening with the independent expertise that academia provided beginning to overlap into the economic development felt by society (Etzkowitz & Leydesdorff 1998). By challenging traditional forms of industrialization in society, they proposed that the position of science (as well as scientific knowledge) had transformed with time. With this transformation, the contributions of science into different economic areas now called for the knowledge that developed from science to be disbursed outside the limitations of traditional uses (Etzkowitz & Leydesdorff 1998, 2000). The uniqueness of this view on science helped form the conclusion that ‘entrepreneurial universities’ could contribute to regional economic and social development through research. It was concluded by Etzkowitz and Leydesdorff that through cooperation with government and industry, research demands could be distributed with greater efficiency to academia, and by meeting the demands of society’s needs, the ‘entrepreneurial university’ could be a more efficient innovator in the cycle of the economy (Etzkowitz & Leydesdorff 2000). While reliance on science never exited the realm of society, it was merely viewed in a more diverse manner, and this was the foundation for the research into the helix.

The decision to apply this model to the mountain pine beetle dilemma was due to the connection between the role of the helix and the economic infrastructure it contributes to regional development. “The emergence of the Triple Helix can be identified as a key factor in regional development” (Etzkowitz & Klofsten 2005), therefore its innovative potential is appropriate when applied to the 100 Mile House region.
3.4.3 Regional Networking

The argument that is developing in this paper is that a regionally based system of innovation is possibly the most ideal suggestion for the problem at hand. While there are many sources of innovation available at many different levels, the following reason confirms why focusing on the problem from a regional perspective is the most applicable decision. These explanations stem from Asheim and Isaksen’s (1997) research on regional innovation systems in Norway:

1. “Innovation... is central to economic growth in regions as well as countries. To stimulate innovation activity should therefore be one important element in regional policy” (Asheim & Isaksen, 1997, p 314)
2. “A regionalization of innovation policy is necessary since innovation occurs differently in different regions depending on the firm and industry structure as well as on varying social and cultural conditions” (Asheim & Isaksen, 1997, p 314)
3. “Innovation is often territorial phenomenon, and the innovation process is in part based on formal and tacit knowledge” (Asheim & Isaksen, 1997, p 314)

As it applies to the problem in this research, these three points clearly outline the beneficiary of innovativeness. The beneficiary being the environmentally effected region has connections to all three of these points, and while the initiatives may alter between the actors, the underlying theme is the production of innovation is the regional aspect involved, and the elements of networking.

Networking at a regional level inevitably incorporates “global networks within the district, while keeping its identity and its systemic cohesion” (Albertini 1999, 113), and this systemic cohesion stems from contextual closeness. Having a certain culture as it pertains to knowledge and networking obviously takes on many dynamic features, but at the core of the networking process, the exchange and application of knowledge remains the focus and purpose. In the pursuit of knowledge, networking adds in key elements seen in clusters, in that the actors are driven towards a high state of innovativeness due to better access to specialized information (Porter 1999), and when dealing within regional milieus, the specialized information is flowing between the actors within the region. It is within this exchange of information that bring the importance of networking to the forefront within a specific region: knowledge, skills and competencies are often exchanged and discovered from both local and global networks, either internal ones or external, but it is within a specific region that this knowledge, and inevitably innovation, is seen beneficial (Albertini 1999).

The motivation behind incorporating networking into this study is the implications it holds with innovation systems. In order to generate a system of innovation, you first must “have several different actor groups who can be brought together under a single umbrella and commonly share an action orientated vision, and who are capable of acting collectively” (Christensen 2005, p 62). Once under that umbrella, the level of connectedness between these actors will dictate the success of the system, due to the fact that cooperation and group cohesion is needed to guide the process. This fact is elevated even when networking at the regional level due to the heightened state of contextual exchanges (as witnessed with untraded interdependencies), and the fact that it is rare for resource-dependant regions to have “proximity without intimacy or interaction” due to the embeddedness in cross-industry dependencies (Brown et al. 2000).

3.5 Dimensions of the Triple Helix

How the actors within a region collaborate is reliant on two interdependent dimensions that encapsulate the helix as a whole: linear knowledge flows and the endless transition of knowledge in innovation. The purpose in addressing these dimensions in the discussion of the helix is due to the effect that they have on the linkages between the three actors, and the acquisition and contribution of knowledge. Building towards innovation cannot occur without technology,
innovation and knowledge being the heartbeat of the helix, and this must be linked between the actors in an effective way otherwise it is lost. Therefore, these two interdependent dimensions offer an all-important foundation for the success or failure of the system on a whole, and that is due to the important roles they have in controlling the underlying nature of the actor’s relationship.

3.5.1 Knowledge Flows

Cognitive exchanges of expertise in form of knowledge flows between the actors of the helix occur in two different forms: contextually or codified. There are similar terms that have been coined to contextual and codified knowledge, for example Nonaka and Takeuchi (1994) ‘tacit’ and ‘explicit’ knowledge or Ryle (1997) ‘know-how’ and ‘know-that’, but this report will primarily address knowledge as either contextual or codified.

The level of resistance in the flow of either contextual or codified knowledge between actors can be defined as the level of ‘stickiness’ or ‘leakiness’. As discussed by Brown and Duguid (2001), learning is the process of acquiring knowledge, therefore in the context of the helix, releasing, or leaking, knowledge plays just as important a role. From the viewpoint of the actors, the attempt to prevent knowledge from leaking outside the network is done to prevent a loss and give actors outside their boundaries an advantage, whereas stickiness is the movement of knowledge between the actors within the borders of the network (Brown & Duguid 2001, p 199 – 200).

3.5.2 Contextual Knowledge and Codified Knowledge

Contextual knowledge is often regionally, socially, or culturally embedded knowledge that derives from a homogenous culture or network. For those outside of the sphere of understanding, contextual knowledge is often ‘sticky’ and stays (does not leak) within the network using the knowledge (Albertini 1999, p 112; Brown & Duguid 2001, p 200). The reason for this level of stickiness with contextual knowledge is the difficulty in identifying and categorizing a form of knowledge for a user outside the cultural base of the knowledge. For those outside this sphere, the process of generating useful contextual knowledge, once garnered, begins with the de-contextualization of knowledge from which the knowledge can be applied to an appropriate context (Albertini 1999, p 111). But due to the social dimension involved in contextual exchanges, actors outside the community make experience a situation where knowledge rarely takes shape as being ‘leaky’, therefore unusable because of the mental inaccessibility.

Because contextual knowledge is so interiorized within actors of a network, measurement of the amount of tacit sharing is difficult, if not impossible. However, understanding that the process of sharing does indeed include this very important element is imperative. This tacit dimension was addressed earlier in the development of the definition of innovation, and because this report is dealing with the development of a regional system of innovation, the motivation for addressing contextual knowledge is justified.

Whereas contextual tendencies take shape with an element of cultural embeddedness, codified knowledge can be exchanged with greater ease between actors of differing networks. In an era of high technology and global communications, the implications of exchanging codified knowledge removes the necessity of geographical proximity in learning due to the freedom of movement experienced by the information. The biggest difference that separates codified and contextual knowledge is the interiorized element and tangibility degree that differentiates the two. Codified knowledge can be more fluently exchanged between various autonomous actors (Albertini 1999, p 111) and this gives knowledge the ability to foster and grow as a result of the potential diversity of knowledge inputs between actors.
The reason for addressing this dimension of knowledge in this report is because innovation systems experience the most benefits when there are greater rates of knowledge exchanged. Because codified knowledge offers a more tangible component of information then contextual, addressing this in the information collection will benefit the conclusions of the report. Codified knowledge is perhaps more measurable than contextual, but for the sake of this report, evaluating the degree of exchange and the fluency of the knowledge exchange will provide many conclusions in terms of the relationships between the actors, and verify or falsify whether or not innovation can thrive under the guise of their ability to communicate.

3.5.3 Linear Knowledge Flows

In order to begin developing a functional helix, a vital element to start from is linear knowledge exchange and the development of a knowledge base (Etzkowitz & Klofsten 2005). The characteristic of linear knowledge flows that benefits the helix the most is in its ability to contribute “new ideas and alternative models based upon interdisciplinary and spiral links between technology and science” (Etzkowitz & Leydesdorff 1998, p 203). Within regional development, having interdisciplinary networking creates a wider breadth of skills that contributing to one another, but this must be effectively communicated between the actors. In addition, these interdisciplinary knowledge flows are critical in developing a knowledge base from which innovation can result. Interdisciplinary knowledge flows are directly related to the cross-fertilization of information that a functional helix aspires to create, and therefore these knowledge flows must be present in order for the helix to reach a point of equilibrium.

In one example of testing the knowledge flows within the helix, Saad and Zawdie (2005) looked to Algeria for answers. From their research, they concluded that knowledge transfer was the facilitator in producing societal advances (technologically and for the regional economy), but when the actors are unable to effectively make these transfers, the helix fails. They further concluded that the “transfer of knowledge can be expected to succeed when organizations acquire the ability to assimilate and apply this knowledge” (Saad and Zawdie 2005, p 13) as they believe is in accordance with their independent agenda.

The purpose in referring to the Saad and Zawdie (2005) conclusion about knowledge flows is that it addresses the duality of knowledge flows. The two characteristics that are drawn from their conclusion is as follows:

1. Because of the evolving and changing agendas of the actors, the benefits of the knowledge flows to the actors may not be felt immediately
2. Due to this evolution, the helix as a whole remains static, but the knowledge flows strengthen the helix continuously

With these two characteristics in perspective, achieving a continuous linear knowledge flow is an absolute necessity for the helix to be effective, as it is the base from which the actors distribute and develop functional knowledge. It should also be noted that the decision to include linear knowledge flows, as opposed to non-linear knowledge flows, was a conscious decision. The reason for this decision was the assumption that the actors within the region did not currently act in cohesion, therefore did not act as a functional helix. Therefore, the application of knowledge flows takes on a neo-classical stance where the focus “is on markets as networks in terms of input/output relations amongst” (Etzkowitz & Leydesdorff 2000, p 115) the actors. Henceforth, the exclusion of the evolutionary economist point of view where the “focus on firms as the specific and bounded carriers of an innovation process” (Etzkowitz & Leydesdorff 2000, p 115), which shares similarities with non-linear knowledge flows, has been carried out in this thesis.
3.5.4 Endless Transition

The relevance of the helix in today’s era speaks to the change in perception of science and knowledge development amongst networks of society. If the helix can be a framework for creating a sustainable economy, then the way in which the actors interpret the science involved in the helix is necessary to address. The ‘endless transition’ donates that “sciences innovate in all domains of social and economic life and the innovative environment provides feedback to the innovating agencies” (Etzkowitz & Leydesdorff 1998, p208), and these innovating agencies are the actors of the helix.

The purpose of bringing up the ‘endless transition’ in this study is due to the implications it transcends to innovation, which is so directly embedded within the helix model. The development of innovation from the ‘endless transition’ theory has three key characteristics (Etzkowitz et al. 2005), and within it is the connection with science transitions:

1. The transition in relationships towards applied research, basic research and product development, and how the boundaries between the elements are being lifted and the three phases are working together
2. The transition in the cross-fertilization of knowledge between different industries and disciplines in order to create interdisciplinary collaboration
3. The transition working towards the ideology of the helix where the actors work on an endless transition towards innovation rather then journey towards an ideal model of knowledge

The dimensions involved in technology, innovation and institutions all correlate to the system of innovation that the helix represents as a whole. As it relates to this study, the development of the regional economy cannot achieve sustainability through innovation without these three dimensions being intertwined within the relations of the actors. Etzkowitz and Leydesdorff concluded that the goal of ‘the endless transition’ of science is “to build upon existing resources so as to create niches of technological innovation” (Etzkowitz & Leydesdorff 1998, p203). Within this theory of innovation, the research done on the environmentally effected region will seek to bring out the elements of this attempt at innovation through the ‘endless transition’.

![Diagram of Static Helix Model](image)

Figure 5 Allan Cole Roberts (2007), Static Helix Model

3.5.5 Push & Pull Factors

If the helix were to be viewed as an innovation system, the simplest way to view the system in its equilibrium would be to assess macro and micro factors. If the dimensions mentioned previously (endless transition and knowledge flows) shall encompass the system on a whole, then viewing
them as macro factors would result in their needing to exist for the system to be in equilibrium. At the same time as this and at a micro level, the factors between the actors (push and pull relationships) would then need to be functioning as well for the system to be in a full state of equilibrium. In addition, efforts to identify and evaluate the push and pull factors will directly speak to the flows of knowledge, the type of knowledge being facilitated (contextual or codified) and areas of deficiency in the channels between the actors. Before getting into the importance of these push and pull factors, it is important to address the relation between these factors and the creation of an innovation system.

Within an innovation system, the actors are working based on their own agenda (Etzkowitz et al. 2005) and due to the fact these agendas change over time, the helix will remain a static process, as mentioned in knowledge flows. Because the level of static in the system is very difficult to measure and control, the closest connection that can be made to the interdependent elements that exist between the actors are derived from push and pull factors that are present in the system. The innovation system has a series of roles that are connected to the push and pull factors, and “the control in a system of mutual interdependence increases the uncontrollability” (Etzkowitz et al. 2005, p 6) of the factors. What this means is the changing elements that the actors create because of interdependent agendas makes the system on a whole difficult to control, but with the goal being innovation, then exclusively, the push and pull factors would be extremely difficult to moderate and grasp (Etzkowitz & Leydesdorff 1998). However, when working in unison with the actors, these factors are more measurable and relevant in their application towards a system of innovation.

With reference to the issue that this research is seeking to investigate, the ideal outcome will be an innovation system in the region. Because a functional innovation system has the potential to initiate economic change and development, distinguishing the factors that connect the actors will be used as a springboard to help identify the current status of the region (this will be addressed again later in the methodology chapter). The theory of the helix contains very independent actors whom interact in a manner where their interdependencies intertwine with the result being innovation (as described in the endless transition). But in order to understand their interdependencies, “analyzing the interplay of the actors” (Etzkowitz et al. 2005, p 4) is necessary to generate a better understanding of the network that exists at this present time. Therefore, the nature of interplaying roles will be studied through the use of push and pull factors.

3.5.5.1 Government’s Role

Due to the lateral transition of knowledge transfers in the helix, governments typical top down policy developments take on a different role. The lateral approach to knowledge sharing imposes that “innovation policy should be seen as the cumulative result of interaction amongst government, businesspersons and academics” (Etzkowitz & Klofsten 2005, p 254). The implications that this has on the government’s role are that they develop policies for innovation that push outwardly collaborative efforts amongst the actors in the helix. Typically, government policymaking takes effect when economic failures occur, and this usually happens when they act alone rather then with other actors. Therefore, the best possibility for regional innovation to flourish is government understanding the areas of the economy to “push appropriate regulations and financing schemes” (Etzkowitz & Zhou 2006, p 80), much like was seen in the “Route 128” example. This may be a general characteristic of government in virtually every facet of society, but government is often the primary financier of social cause, which holds just as true in the development of an innovation system. “Government supports the framework for creation and implementation of innovative activity in many ways” (Etzkowitz & Zhou 2006, p 80), and one of the ways must be through democratic relations with the other actors in the helix.
Governing global environmental stewardship is the first pull factor that is easily identifiable, and it starts by encouraging sustainability regionally. Sustainability issues are scenarios where government funding can spawn innovative behavior, and this innovative behavior creates change. The pull factor displayed here is witnessed by redistributing public funding in order to create sustainable enterprises (Freimann et al. 2002), and environmental entrepreneurship can help diversify the region away from environmental reliance, as seen to be detrimental with instances such as the pine beetle. One specific form of innovation pulled into regional economies is integrating linkage mechanisms between the actors through knowledge-related subsidization, and this is a step towards the creation of knowledge-based economic development (Etzkowitz 2002). These linkage mechanisms pull in representatives from the actors of the helix, and if the contributions of the interdependent actors are knowledge creation, the linkages formed by government initiatives move the helix closure towards equilibrium.

Key Government Outputs

1. Regulation & Financing
2. Policy Making

Key Government Inputs

1. Regional governance towards stability
2. Initiating linkages for knowledge creation

3.5.5.2 Industry’s Role

Whereas government and academia display characteristics more closely associated with the contextual nature of the society they work within, industry does not experience regional isolation to the same degree. Technology and innovative knowledge are in high demand (pull factor), but this does not mean it must be provided only at a regional level. The study of the relevance of the helix in Brazil conducted by Dagnino and Velho (1998) concluded “local industry does not require local technology” (Dagnino & Velho, 1998 p 22). The effect this has on the helix on a whole is felt two-dimensionally, and has a direct impact on the relationships between the three actors. First, global standards in terms of industry technology are developed from a network of practice between cooperating institutions that is used by industry. The network of practice used by institutions is therefore in high demand by industry actors due to “firms (being) unlikely to create their own research and development… of technologies” (Dagnino & Velho, 1998 p 22), which is the second dimension of this partnership. As mentioned earlier in this chapter, codified and contextual knowledge are being exchanged in a functional system of innovation, and that was reconfirmed in the report conducted by Dagnino and Velho.

The paradox created by industry when the flows of the helix feed one another lies in the nature of the economy it is situated in. If natural resources are the focus of this study, then the environmental predicament created through change initiates a pull factor in industrial supply of economic stability. “Industry (firms) are the main subject and user of innovation (therefore) provides a pull force to the helix” (Etzkowitz & Zhou 2006, p 80), and this pull element is a direct result of environmental constraints or opportunities. What is displayed in this pull factor also speaks out to the role of science-based regional development of economies, and this reliance of the actors on one another displays the state of equilibrium the helix needs to be in to maintain sustainable innovation.

This study considers those working as an industry actor as those working within natural resources, but for a helix to be in equilibrium, it’s important to consider other forms of industrial actors, for science-based companies add a new push element to the characteristics of industrial
actors. The element entailed here demands for cooperation and working within networks of practice in order to create a flow of information sharing. Etzkowitz and Leydesdorff (1998) concluded that the push from industry for cooperation stems from “companies no longer being an island unto itself” (Etzkowitz & Leydesdorff 1998, p 203) and this is where the olive branch extends directly to the research capabilities of the academic world. Infrastructure to develop the necessary technology simply is not accessible to all industrial actors the way it is provided by the institutions, therefore accessing their knowledge by pushing for cooperation is necessary in order to keep the innovation system in equilibrium.

Key Industry Outputs

1. Cooperation with university extended from industry as a result of need for knowledge development
2. Foundation for economic stability

Key Industry Inputs

1. High demand for technology and knowledge (regional and global standards)
2. Primary user of new technologies

3.5.5.3 Academia’s Role

Part of Etzkowitz and Klofsten’s conclusion in their 2005 research on the helix in regional development stated the “university takes in inputs and problems from the local environment and translates the outputs of academic knowledge into economic activity” (Etzkowitz & Klofsten, 2005, p 254). This role in the innovation process confirms that regional development employs both the scientific and academic characteristics that academia offers. The output of knowledge provided by academia is therefore “looked to for technology and future industry” (Etzkowitz & Klofsten, 2005, p 254), but it is important to analyze to what extent input into academia is occurring.

The degree to which academia receives inputs from government and industry was supported by Etzkowitz and Zhou (2006) in forms of push and pull dynamics. Within a functional, innovative helix structure, “university (acts) as a push force through knowledge and technology transfers” (Etzkowitz & Zhou, 2006, p 80). Because the roles of the actors have varying dimensions and responsibilities in order to keep the helix in equilibrium, the push/output results born from the university must be born from pulling or receiving inputs from the other two actors. When this is achieved, the cycle of innovation can have sustainability.

Key Academia Outputs

1. Academic knowledge looked to for technology and future industry
2. Push force through knowledge and technology transfers

Key Academia Inputs

1. Problems in the local environment
2. Deficiency of knowledge in vital areas
3.6 Concluding Remarks on the Literature Review

Now that the literature review has narrowed down the core theoretical components that are used in this thesis, the procedures to follow will work more closely with the practical issues in the study. To reiterate the strategy involved in this chapter, readers should note that the theories were all from the academic community and the breadth of the subjects was intentionally minimized to be the appropriateness of this study. In addition, allowing for the authors voice, in terms of interpretations and conclusions, was attempted so that the study works towards an exclusive and original contribution of knowledge for the academic community.
4 PRACTICAL CONSIDERATIONS

The intention of this chapter is to introduce the reader to the practical problem at hand. The problem will be explained in greater detail in terms of the source, the effected area and the role innovation could possibly play in deriving a solution.

4.1 Background

As mentioned in the introduction, the purpose of this paper is to offer systematic solutions to an environmentally changing region. However, the environmental change the world has experienced has not been thoroughly outlined to this point. That is the intention of the section to follow, and by reading this section, the beetle kill problem will be understood in far greater detail.

It is also beneficial to note that there are Internet sources used in the information gathering. However, only government references are sourced, therefore the credibility of the statistics need not be challenged.

4.2 Environmental Change

The United States Department of Commerce released information in 2006 stating that in recorded history, “nine of the 10 warmest years on record have occurred since 1995” (NOAA). Undeniable evidence supports this statement, and the reality of global warming has resulted in horrific environmental damage worldwide. To outline some of this damage, 2005, the warmest year in recorded history according to the U.S. National Climatic Information Center, will be used to illustrate some of the repercussions of a warmer planet. The list will be kept to a minimal, but these examples are meant to bring light to the issue.

Mumbai, India was devastated by over 37 inches of rain in only 24 hours resulting in over 1000 deaths in late July of that 2005 (Banner et al. 2005). Just over a month later, Hurricane Katrina claimed an additional 2,000 lives and left the American reeling after the $80 billion dollars spent on recovery measures in New Orleans (MSN News). Post-Katrina oil prices reached unthinkable highs ($45 per barrel in January 2005 to over $70 per barrel in September 2005) sending out an economic ripple effect felt by the entire globe (Europa EU 2005). 140 towns in Romania were left at an economic standstill, as 30,000 hectares of land was flooded in the northern and western regions (Stephens 2005). Severe drought in Thailand left two million hectares of farmland damaged resulting in $191 million in lost economic revenue (Stephens 2005). The same drought season affected the Yukon Territory in Canada as it experienced one of worst forest fire seasons in recorded history. The result of this fire was carbon monoxide emissions exceeding 30 billion kilograms released into the world’s atmosphere (CBC 2005).

4.3 The Mountain Pine Beetle

The year 2005 was also the year that a record number of timber-reliant mills closed in Canada with 32 being forced to discontinue business activity (Natural Resources Canada). The vast majority of these closures, especially in western Canada, were due to one environmentally related reason: the mountain pine beetle.

In the western Canadian province of British Columbia, the outbreak of the mountain pine beetle (Dendroctonus ponderosae) has reached epidemic levels, causing havoc for the forest industry. The problem with the pine beetle is that it acts much like a virus inside lodge-pole pine trees, and the issues surrounding infected trees is twofold. First, infected wood develops a blue stain that deters

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6 All dollar figures are American currency
buyers because of the aesthetic nature that is clearly distinguishable in its appearance. Secondly, infested timber will eventually become too dry to mill into lumber, and considering the economics involved in resorting to other timber, the deterrence from pine trees is costly for mills (Sierra Club of Canada 2005). Due to the inability to produce a sustainable product from infected pine beetle, the industry in affected areas becomes constrained from the lack of production. The inevitable reality, therefore, is mill closures, lost jobs, and declining economies in timber-reliant regions.

While the pine beetle has always had a natural presence in the environment, the recent outbreak has been a result of warmer winters (Drever & Hughes 2001). Nature’s natural course of action to moderate acceptable levels of the pine beetle was typically forest fires and, more significantly, cold temperatures (Natural Resources Canada) that would keep the amount of beetles in equilibrium with the required living amount in the forest. “Sudden cold snaps (-25 degrees C) in the early fall or late spring, or sustained frigid winter temperatures (below -40) can decimate beetle populations and help end serious outbreaks” (BC Ministry of Forests 2001), but global warming makes the feasibility of this very low.

The consequences of a warmer planet has increased the spread of the beetle and by 2005 (the warmest year in history), over 450 million cubic meters of pine forest had been eliminated and the beetle had extended to 8.7 million hectares of BC’s forests (Natural Resources Canada). Unless the earth’s temperature drastically cools, the Government of Canada has projected that by 2013, approximately 80% of BC’s mature pine trees will be affected by the pine beetle (Natural Resources Canada), deeming the wood unfit for economic reliance.

4.4 The Cariboo Region

One of the six regions in BC is the Cariboo. Located in central B.C., the Cariboo’s regional economy employs 82,900 (Statistics Canada 2006) people, with 4,800 directly employed in the forestry industry (Ministry of Sustainable Resources 2006). Further demographical breakdown of the region states that within the three main towns, Williams Lake, Quesnel and 100 Mile House, the forestry sector employees (respectively) 26%, 35% and 23% of the inhabitants (Ministry of Forests 2001).

100 Mile House will remain the focus for the study due to its increased reliance on the timber industry, and the perceived impact of the environmental change felt in the community. With a population of 1,739 (Statistics Canada 2007), the effects of mill closures and a declining timber industry as result of beetle kill will alter the economy of the town drastically. Where Quesnel (population 10,044) and Williams Lake (population 11,153) (Statistics Canada 2006) have more diverse economies that rely significantly less on timber, 100 Mile House would cease to exist without forestry. The situation has now created a demand for innovative solutions in order for the community to have a sustainable economy during this period of environmental change. If this innovation does not occur, then the reality of the community becoming a ghost town is not out of the question.

4.5 The Role of Innovation in Environmental Change

This study will connect innovation, and it is role in developing sustainable economies, to 100 Mile House and its fledgling economy, with the attempt of the connection to create solutions for suitability. Etzkowitz and Leydesdorff (1998, 2000) have introduced the model of the Triple Helix and suggested that the interdependent cross-fertilization between government, industry and academia encourages innovation. The Triple Helix has been applied to a plethora of regions around the world (Singapore, 2006; West Midlands, UK, 2006; Chile, 2005; Australia, 2004;
Sweden, 2004; Brazil, 2004; Algeria, 2004; Japan, 2001; Mexico, 2000; South Africa, 2000 et cetera) with the general conclusions agreeing that the Triple Helix model can be a starting point to the development of an innovation system. If the role of innovation systems can be incorporated into regional development, this study aims to seek the viability of such a proposal in a region searching for economic sustainability.

4.6 Concluding Remarks on Practical Considerations

With the practical framework in place and the theoretical framework aligned, the research question will be answered through the collection of information from those most effected by the beetle kill. Because the practical issue at hand is part of a long-term system of change in the region, the solutions offered for the economy should be considered as part of this sustained change.
5 PRACTICAL METHODOLOGY

This chapter will now bring forth the practical application of information collection. Encompassed in this section will be the selection of information collection, a description of the incumbents used in the research, and acknowledging the potential biases in the research.

5.1 Selection of Information Collection

The information collection process commenced via semi-structured interviews. As mentioned in the research paradigm, this thesis is grounded in an interpretive epistemological orientation and therefore the information must be examinable without being burdened by strict statistical regulations and formulas. This qualitative approach will seek to analyze discourse and conversation (Bryman & Bell 2003, p 282) that is projected by the actors in the interviews, and from this the conclusions can connect what the relations are, how the actors interact, and where the flows of knowledge are or are not exchanged.

There were other considerations for qualitative methodology proceedings, but in the end the ability to interpret the information was seen as most feasible through interviews. If this thesis had attempted to garner beneficial conclusions through the use of questionnaires, surveys, ethnography or the plethora of other research options, the voice of the decision makers would not have penetrated the theories in a manner where conclusions can be drawn as effectively.

5.2 Interview Settings

In order to conduct the best interviews possible, being physically present in the milieu was selected as the best option. That being said, leaving Umeå University and traveling to 100 Mile House, British Columbia in order to carry out the interviews in person was a decision made in order to benefit the study. Conversational interviews, either via the Internet or telephone, were also considered, but in the end, the conclusion was reached that face-to-face interviews would garner the most receptive information.

In addition to the interviews being orchestrated in person, allowing the incumbents to choose the location allowed for the most advantageous atmosphere for questioning. Because the information collected was the onus of interviewer to decipher, the same onus is responsible for allowing the incumbents to be as comfortable as possible in their chosen setting.

Throughout the interviews, it should be noted that they were recorded with a Dictaphone and deciphered through scribing them afterwards in order to garner a more detailed form of analysis.

5.3 Interviewing Procedure

In order to conduct the most efficient interview, the flow of the interview was guided through the use of an interview guide. The development of the guide was done in a manner so that the approach to research, deductive, began with the application of the theories, and that collection of theory being tested versus the practical problem. The main priority in the interviews was to “give the interviewee a great deal of leeway in how to reply” (Bryman & Bell 2002, p 343), and the best way to accomplish this was to focus on very open-ended questions that were inspired from the theories. Flexibility was imperative in the process, and the strategy behind semi-structured interviews would inevitably accomplish this.

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7 The ‘interviewer’ was the author of this thesis, Allan Cole Roberts
8 See Appendices for interview guide
The priority in the actual construction of the interview guides was to not lose focus of the research questions, so the questions were exclusively inspired from the theoretical findings. From there, the decision was made to break the guide up into three main segments: identifying key definitions, relating the championing features of the chosen innovation system, and customizing the interactions between the actors. The first two segments were identical for all incumbents, and the reason for this was to allow for a cross-comparison of their varying opinions. However, the final segment of the guide was more actor-specific, due to the various roles played by the actors in the helix configuration. When selecting which points to include in the guide, it was important to restrict the number of topics covered so that the interview would remain semi-structured and free flowing.

It should be noted that upon completing the interview guide and confirming the interview times, there were two options relayed to the interviewees. As noted by Bryman & Bell, “researchers often provide a copy of the interview guide to the (interviewee) upon request” (Bryman & Bell 2002, p 348), and this was made available to the incumbents. In addition, the choice of anonymity was left to the discretion of the incumbents. While nobody chose to remain anonymous, the motive behind giving the option was so that answers would not be restricted by fear of who the final reader might be, and the opinions they may form of the individuals responses. Finally, the option to view the final result of the thesis, including their interviews was given to all the interviewees.

Aside from the core information supplied in the interviews, an overall briefing of the interviews was made once each interview was completed. The points included in the reviews included the following key points (Bryman & Bell 2002, p 349):

1. How the interview went
2. Where the interview took place
3. Any other feelings about the interviews
4. The setting

Answering these questions would offer small insights into the interview process, and how these variables could have possibly changed the outcome of the study.

5.4 Processing the Information

For the empirical information section, there were certain decisions made in terms of the presentation of the information. Because there were two incumbents chosen who best represented their respected actor in the helix model, their interviews would be presented on behalf of that particular actor (government, university or industry). The purpose behind this was to bring cohesion to the actors so that the information collected would represent not only the individual, but also the actor as an independent entity.

In order to do this, the empirical information was presented in a way so that the actor would have a consistent, fluid voice throughout. Therefore, excluding the inevitable information that was irrelevant (such as personal information and unrelated interviewee biases such as politics or opinions on competitors) became part of the interpretation process. The result was the selection of information that complimented both individuals interviewed for that particular actor, creating not only consistency, but also verification for the information.

The information is presented in noticeably different sub points for each of the three actors. Again, this decision was reached in order to best relay the most vivid pieces of information delivered by the incumbent. Obviously the findings were more accurately harmonized in the
information analysis, but for the sake of presenting the information, the decision was made to bring forth the most impetuous points expressed by the individual actors.

5.4.1 Aversion from Abduction

The final point to address in the processing of the information was the elevation in quality (on behalf of the interviewer) that occurred throughout the process. What was observed as the process went on was actors elaborated on certain theories more than expected, and the result of this was re-referring to certain pieces of information. While various points were discussed, the questioning remained the same throughout in order to remain consistent. The main change that occurred was a heightened state of alertness on behalf of the interviewer in regards to certain theories that were not heavily incorporated into the interview guide.

The purpose in pointing out that the information collection had elements of referral back to the theories is the similarities to abductive research that could enter into the thesis. The core difference between deductive research and abductive research can be viewed much the same as the difference between predicting and explaining, as explained by Shanahan (1988). What was explained earlier in this study in the justification of study techniques was the process was to “project forward from causes to effects” (Shanahan 1988, p 1057). This is the fundamental backbone of a deductive research design, where an abductive process would “reason from properties and event, to events that may have caused them” (Shanahan 1988, p 1057), where an explanation would then be given.

This is where the reader should not confuse this process. Simple re-referring back to information in order to understand a deeper meaning does not justify a study seeking to explain a phenomenon, but rather offer a prediction of its future. When this study was conducted, the intention was to gather information as inspired by theory, revert that theory into information collection measures, and predict the results of implementing a system in the most functional manner. By simply coming to that conclusion by using general reasoning, as often times witnessed with abduction, would be undutiful in the process, therefore, interpreting the information will allow the paper to offer a valid prediction for this particular milieu, and all others who apply this papers findings (Shanahan 1988).

5.5 Interviewer Requirements

In order for the connection between the interviewee and the interviewer to garner the most relevant information, the following ten requirements were incorporated into the process. As outlined by Kvale (1996), the qualifications below have to be present within the interviewer:

- Knowledgeable: This would include a balance of the practical issue being studied and the theories being applied to the research
- Structuring: The flow of the interview must be done in a way so that the interviewee understands the direction of the interview and can logically follow the questions
- Clear: The questions asked in this particular interview mustn’t be confusing or off topic. This is a tacit element that will come forth in the communication abilities
- Gentle: Because this is the principle information collection method in this research, allowing the interviewee to finish every thought is vital. In
that light, letting conversations and statements conclude naturally is vital.

**Sensitive:** Because the interviewee is viewed as the information collections greatest asset, they must be treated with respect and empathy

**Open:** The danger of unstructured interviews is going off of the main topic. However, being flexible to the interviewee’s opinions and statements is important in order to gain a broader perspective of opinion

**Steering:** This is derived from exactly what is needed to learn from the interviewee. Steering the outflow of statements through useful questioning is clearly the interviewer’s responsibility

**Critical:** The ability to question in more depth and respectfully challenge the interviewee will generate the most useful replies for the sake of the report

**Remembering:** Repeating questions or being oblivious to previously stated opinions is a sign of disrespect, therefore being strictly attentive is a must

**Interpreting:** Interpretation in greater depth is done in the analysis stage, but during the actual interview understanding what is being said and interpretation where the interview should feed from the statements will add breadth to the process

These ten points are inescapable qualifications that were put on the shoulders of the interviewer. If these were not all consider, fluency in the interview wouldn’t be present and without question, experienced researchers, politicians and business people would notice this. If the interviewee observed a deficiency in any of these qualities, then that could potentially alter the information that is being collected.

### 5.6 Interviewee Requirements

Whilst deciding who would be ideal for the interview process, the following five criteria were generated:

1. Must possess decision-making capabilities, and authority, due to their professional position
2. Must have a plethora of experience in strategy development and implementation
3. Must have a vested interest in the region and contain a high level of economic and social knowledge
4. Must have been effected, in some capacity, by the pine beetle epidemic
5. Must have a balance between academic and professional knowledge, albeit the weight of experience is variable

To explain how these points were generated, it is necessary to re-address the research objectives and the information needed. Relating interpreted information back to the wide breadth of theories in the analysis chapter requires information to be supplied from a credible group of individuals, so relating the requirements to the objectives of the study was considered. If even one of the requirements were missing, it could easily bring question to the conclusion due to the specific nature of the innovation system being applied to the practical issue at hand.
Once the interview requirements were generated, then short-listing the candidates was done. Initially, there were a wide range of potential incumbents with a wide range of qualifications and positions. That list spanned to four incumbents for each of the actors, and within these four actors availability and interest were the next requirements. Luckily for the sake of the study, all of the potential interviewees were interested in participating, but timing became an issue. In terms of timing, all the incumbents worked in accordance to their own schedules, so one hurdle was averted. In studies such as this, intruding on employees during hours of operation can be a problem, especially “when employees are paid on an hourly basis, this becomes a particularly important issue” (Bryman & Bell 2002, p 347). That was not the issue, however, as it was simply a matter of being in the region when the interviewer was there. Due to the fact that a trip from Umeå, Sweden was organized with a set deadline arranged for the return flight back, orchestrating the interviews for the time the interviewer was there was imperative. In the end, the final six candidates met both the interviewee requirements and the timing factors, which was absolutely positive for the study, and this was witnessed in the results that were generated.

5.6.1 Industry Incumbents

Don Johnsson

Incumbent Overview

Johnsson is a seasoned forestry consultant with over 25 years experience. Johnsson’s consulting efforts extend to all aspects of the business, ranging from company strategy to training programs to buyouts and mergers. The diversity in Johnsson’s experience is due to the progression made up the hierarchical positioning of the industry, and there are very few aspects to the industry outside Johnsson’s understanding.

Johnsson’s resume boasts working for both corporate giants and privately owned businesses. Most recently, Johnsson worked closely with West Fraser Mill in 100 Mile House on adjusting to the pine beetle epidemic, allowing for first hand experience in the change process. In addition to a variance in size of firms, Johnsson has an international background with projects conducted in various timber-rich nations.

Selecting Johnsson was due to the combination of unlimited knowledge, history in the industry, and the capabilities to advise current industry participants. Should the feasibility of this study be verified, Johnsson’s invaluable expertise and credibility is undoubtedly necessary.

Key Contributions

Plethora of experience in many capacities, regional expertise, voice in the direction of the current industry

Interview Time

1h 07m

Interview Location

WFM, 1214 South Birch Ave., 100 Mile House, Canada

Interview Date

March 19th, 2007, 12.30

Interview Overview

In comparison with the other incumbents, Johnsson was the most relaxed and treated the process as more of an elaborate conversation
then a scientific study. Regardless of this laid back approach, the information was absolutely necessary for the study and his practical information of the industry was vast. The flow of the interview was smooth, and it was simple to connect practical experience with the majority of the theoretical applications. Overall, Johnsson was very open, quite enthusiastic about the interview, and answered questions with no preconceived notions of any kind.

Criticism of Source

While practical, real-life experiences are fundamental for the study, the connection between his answers and the theories lacked an academic approach. Interpretation and connection was not a difficult chore in the analysis, but during the actual interview, the connections to the theories was difficult to keep on due course. The reason, presumably, was due to the breadth of Johnsson’s experiences and disconnection from the world of academia.

Walter Bramslaven

Incumbent Overview

Bramslaven’s primary occupation is the General Manager of Sitka Log Homes in 100 Mile House. The significance in selecting a person in his position is the importance of the Lodge Pole Pine, which is Sitka Log Homes premiere timber choice. Outside of the mills and logging occupation, log home building in this region is a major source of income, and Sitka is the largest company in the region. The outcomes and decisions the industry makes will directly affect Bramslaven’s company, albeit Sitka works hand in hand with suppliers in decision-making.

In addition to being the leader of the region’s premiere value-added supplier, Bramslaven sits as a member of the Advisory Committee for the Cariboo-Chilcoten Beetle Action Coalition. The focus of this coalition is to work with the ever-changing dynamics of the region as a result of the epidemic. Seeing as the pine beetle directly affects Bramslaven’s livelihood, the level of participation in the changes is quite natural.

Aside from Bramslaven’s seat on the advising committee and the role as general manager, it is also important to address Bramslaven’s vested years in the community and the many roles played. While Bramslaven hasn’t always been involved with timber, heavy involvement in the effected community has been high, therefore creating solutions is engrained in Bramslaven’s daily processes.

Key Contributions

Manager of elite timber based value-added company, member of coalition advisory board, regional knowledge, voice in the future development of the industry

Interview Time

0h 46m

Interview Location

Sitka Log Homes, 5454 Tatton Rd, 100 Mile House, Canada
Interview Date
March 24th, 2007, 13.30

Interview Overview
The similarities between Johnsson and Bramslaven’s approaches to the interview were quite noticeable. Very comfortable, very relaxed and offering a lot of practical knowledge, the Bramslaven interview was quite conversation-like and free flowing. The choice of location for the interview was Bramslaven’s business office, and that may have resulted in the noticeably relaxed atmosphere during the interview. In addition, Bramslaven’s genuine interest in the study may have enhanced the efforts in contributing relevant answers.

Criticism of Source
Because Bramslaven is competing in a tight industry, often there were references made to other participants in the region, and this resulted in negative connotations. In addition, there were a lot of personal examples and viewpoints that needed to be isolated and excluded from the process of information gathering. The obvious optimistic perspective and community-first approach in Bramslaven’s answers also needed to be acknowledged, and this was plausible due to the biases that perhaps spawned from the position held in the beetle coalition, therefore a high-level of awareness during the interviews was necessary. Of all the interviews, Bramslaven’s would have been the easiest to become sidetracked with, so remaining extremely attentive was essential in order to gather the most relevant information for the research questions.

5.6.2 Academia Incumbents

Bill McQuarrie

Incumbent Overview
McQuarrie is the Executive Director for the Interior Science and Innovation Council (ISIC), which is a direct affiliate of Thompson Rivers University. Much like the university, ISIC services the interior region, and more specifically in regards to this study, 100 Mile House. The purpose of the council is to service individual entrepreneurs, as well as companies, in the region throughout the process of change. They are a council that promotes innovation, leadership and direction, as well as acting as a networking hub to connect potential collaborators for projects.

Being the head of the council, McQuarrie balances practical entrepreneurial ventures with a sound academic background. McQuarrie works closely with both the private sector and the university, and holds a track record for success that is impressive in both dollar figures and in terms of innovation.

Including McQuarrie in this study is primarily due to an intense involvement with innovation, but also interactions with the private sector and academia.

Key Contributions
Innovation knowledge and experience, prestigious member of innovation council, ties with university and private sector, plethora of practical and academic experience
McQuarrie was conspicuously buoyant during the interviews, and the most logical explanation could point to the theme of the thesis being embedded in innovation (McQuarrie’s core competency). However, the mood was very business-like and there was strict adherence to an austere timeline (which was emphasized emphatically). This didn’t render any restrictions though in McQuarrie’s cooperation, and overall there was a fantastic blend of an astute level of academic knowledge with practical experience. In addition, McQuarrie was a gifted speaker in that he balanced lightheartedness with seriousness throughout the interview, which made the process quite enjoyable, but more importantly, exceptionally informative.

Defensive is perhaps too severe a word to use, but there was an aura of caution in the answers given. The caution seemed to be in revealing too much information about ISIC’s strategy for the future, and this could be connected to ‘sticky’ and ‘leaky’ knowledge flows. The relevance in bringing this up lies in the fact that the information given and the reality of McQuarrie’s actions were, in some sense, contradictory when analyzed. However, the genuine nature of the interview should emphasize what was said, as opposed to why or how (Bryman & Bell 2002, p 353).

$Lauchlan Fraser$

Fraser sits on the Canada Research Chair for Natural Resource Sciences at Thomson River University in Kamloops, British Columbia. Fraser has a vast amount of research experience and has supervised a plethora of research projects at many universities. In addition, Fraser has written well over 20 peer reviewed articles and has focused his natural science research on phenomena’s that range from forestry to wetlands.

Incorporating Fraser’s voice into this paper was due to the appropriateness of his position at the university and the focus of Fraser’s research. The conclusions of this report will dictate what specific areas of innovation will be beneficial for the effected region, but it starts with academic research capabilities. If that research is feasible, the person who can answer that question the most effectively is indeed Fraser. In addition, Fraser’s influence at the university could dictate future research affiliations that are possible in the effected region; therefore Fraser’s opinion can dictate the direction of the change for the short and long term.
Key Contributions Research experience and influence, status at the university and the natural resource sector, passion for sustainable natural resources

Interview Time 1h 02m

Interview Location Thompson Rivers University, 900 McGill Road, Kamloops, Canada

Interview Date March 15th, 2007, 11.35

Interview Overview Fraser was an extremely calculated individual, and took serious consideration into every question. Undoubtedly, this is related to his research experience as a reputable, scholarly author. This conscious approach created the most structured interview of the lot, albeit the degree of seriousness didn't hinder the comfortable atmosphere that was somewhat present.

Criticism of Source Being a researcher with an abundance of experience, and a supervisor to many students, created a feeling of hierarchy during the interview. Almost as though the interviewee was to learn something about the world of research outside of the information exchanged during the interview. This spoke to the demeanor of Fraser, as it was vividly obvious he pertains to the notion that students and professor communicate in a certain manner.

5.6.3 Government Incumbents

Joanne Doddridge

Incumbent Overview Doddridge has led the Planning Department for the 100 Mile House municipality for 2 terms. Doddridge’s also leads the Economic Development team that creates and implement strategy for the community. Doddridge has lived in the region for over a decade, and has been working under the governmental umbrella for the latter part of that career. In addition to her personal and professional experience, Doddridge is well versed in sustainability theories due to her prior education in sustainable community practices.

The most important quality that Doddridge possesses in her position is the ability to carry out change for the future of the region. Doddridge’s voice is necessary in this paper due to the fact that she is so empowered when it relates to community strategy. In addition, her experience in the community, personally and career wise, makes her knowledge invaluable. Doddridge has a proven track record of implementing position change in the region, therefore it is essential to use her statements to verify the feasibility of the innovation system proposed.

Key Contributions Community strategy planner and decision maker (economical and practical proposals), vested interest in economic viability of the community, experience with other actors over a long duration, relationship with the theoretical components of the study
Interview Time 0h 46m
Interview Location Municipal Chambers, 385 South Birch Ave., 100 Mile House, Canada
Interview Date March 16th, 2007, 14.00
Interview Overview This interview could be characterized as reserved optimism, and the reason for this was Doddridge’s elusiveness during questioning. Answers were indeed relevant, and the mood wasn’t exhaustingly formal, but Doddridge’s mannerisms suggested that the topics weren’t of primary concern to her. Two external factors may have altered her manners: first, the results of a council election were being addressed, and secondly, it was a Friday, so perhaps she was eager to end the workweek. Again, these are assumptions, but they should be noted due to the relevancies they hold in Doddridge’s contribution to the thesis. Overall, her knowledge came through in the necessary areas, and she was very cooperative with the process.

Criticism of Source While it was never directly stated, it seemed there was an underlining political agenda in the answers received, much the same as with Barnett. Aside from that, the only other consideration would be the unknowns that she is working with in her position as community strategists. It is difficult to know what the right strategies are in a municipality undergoing so much change, and without benchmarks available, Doddridge’s answers were personal options and assumptions in a lot of scenarios.

Donna Barnett

Incumbent Overview Barnett is the mayor of 100 Mile House and has served six terms in that position. Outside of the role as mayor, Barnett has been instrumental in founding the Cariboo-Chilcoten Beetle Action Coalition and she has been a major player in the economic development of the health, educational, and business sectors at a local, regional, and provincial level. Barnett represents the district in provincial decision-making ranging from the Premier’s Task Force on Opportunities, the Council of Resource Communities and the Cariboo Regional District Hospital.

The decision to use Barnett for this report was due to her ability to make economic changes through policy and her clear objectives being the creation of solutions for the pine beetle problem. It is important to also mention that Barnett has been in the region long enough to understand the fluctuations in the relationships between the actors of the helix, and evaluating whether this system of innovation was feasible. Finally, Barnett has the ability to influence the direction of the community in both the short and the long term, and if a system such as the helix were to be implemented, it would take the voice of a leader such as Barnett to make the necessary steps happen.
Key Contributions  Policy changing capabilities, personal interest in the problem, thorough understanding of the actors

Interview Time  1h 12m

Interview Location  Municipal Chambers, 385 South Birch Ave., 100 Mile House, Canada

Interview Date  March 13th, 2007, 15.00

Interview Overview  The interview with Barnett went extremely well in terms of information gathering and the relevance to the research questions, but there were other factors to consider. First of all, the timing of the interview was around a political election in the region (for council positions) and that may have altered the mindset of the mayor. It wasn’t a major issue, but the fact that there were other important issues on her mind questions the authenticity of the interview.

Aside from the timing, the interview was limited in time, and in fact, went over the allotted time space for the interview. Barnett, understandably, has a full agenda, and this day was no different. Why this is addressed is the mood during the first half of the interview wasn’t overly loose, until Barnett was informed that the process was over the halfway point. That relaxed her, and the interview was far more fluid after that point.

Criticism of Source  Being in an elite position in the community, Barnett’s optimism was radiant. The tough questions were answered in a very passive, elusive way at times, and this spawns from her plethora of political experience. The fact that some direct questions were averted through diversion to a related topic, the major criticism of Barnett would be her hidden political agenda in the answers. This was something that was dealt with effectively however, and the core information needed for the thesis was still generated.
5.6.4 Interviewee Review

Table 1 Allan Cole Roberts (2007), Interviewee Summary

<table>
<thead>
<tr>
<th>Interview Time / Location</th>
<th>Key Contributions</th>
<th>Interview Overview</th>
<th>Criticisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barnett (Gov.)</td>
<td>Policy changing capabilities Member of CCBAC</td>
<td>Mindfulness in answers</td>
<td>Blinding sense of optimism Elusive in answers at times Exhausting at times with political referrals</td>
</tr>
<tr>
<td>March 13th, 2007, 15.00, 1h 12m Municipal Chambers</td>
<td>Thorough understanding of the other actors Community Mayor</td>
<td>Strict time limit Plethora of information Far from relaxed</td>
<td></td>
</tr>
<tr>
<td>Fraser (Uni.)</td>
<td>Research experience &amp; Influence Natural resource expert Passion for sustainability studies</td>
<td>Very calculated &amp; serious</td>
<td>Hierarchical atmosphere at times Degree of communication barriers Answers overly embedded in preconceived notions</td>
</tr>
<tr>
<td>March 15th, 2007, 11.35, 1h 02m Thompson Rivers University</td>
<td></td>
<td>Comfortable in discussion Passionate for the subject</td>
<td></td>
</tr>
<tr>
<td>Doddridge (Gov.)</td>
<td>Community planner &amp; decision maker Vested interest in economic viability Plethora of experience with other actors</td>
<td>Feeling of reserved optimism Topics appeared to be outside core interests Slightly distracted, yet cooperative</td>
<td>Apparent political agenda underlining Working with a very under researched area A lot of assumptions and personal opinions</td>
</tr>
<tr>
<td>March 16th, 2007, 14.00, 0h 46m Municipal Chambers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Johnsson (Ind.)</td>
<td>Industry experience Regional expertise Voice in industry strategy</td>
<td>Relaxed Smooth flowing Very practical Enthusiastic</td>
<td>Lacked academic-theoretical connection Disconnection with university</td>
</tr>
<tr>
<td>March 19th, 2007, 12.30, 1h 07m West Fraser Mill</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>McQuarrie (Uni.)</td>
<td>Innovation knowledge &amp; experience Head of innovation council Networking with university and private sector Practical &amp; academic experience</td>
<td>Motivated with the theme of the paper Business-like mood during interview Astute level of academic &amp; practical knowledge</td>
<td>Somewhat defensive Cautious with answers Contradiction in certain statements</td>
</tr>
<tr>
<td>March 20th, 2007, 10.30, 0h 58m Interior Science Innovation Center</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bramslaven (Ind.)</td>
<td>Leader in Timber Value-Added Industry Advisory Member for CCBAC Vested commitment to community Command in industry direction</td>
<td>Comfortable Conversational-like Extremely practical Genuine interest in study themes</td>
<td>Consistent reference to competition Overly optimistic to a fault Biases from position on CCBAC</td>
</tr>
<tr>
<td>March 24th, 2007, 13.30, 0h 46m Sitka Log Homes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.7 Criticisms of Primary Sources

The selections for the interviews were accurately done and relevant in terms of answering the research question. However, there were a few issues that were raised once the process was complete. First of all, the primary sources were certainly at various levels of understanding in the topics covered during the interviews. Obviously different core skills and knowledge speaks to the diversity of the interviewees, but addressing the fact that they were not all on at the same level is important. This was expected though; hence deciding to take on a hermeneutic epistemology was decided at the early stages of the thesis. The second criticism that was apparent during the interviews was the difficulty in keeping the sources on track in terms of the core points.

5.8 Criticisms of Interviewer

When addressing areas for criticisms for the interviewer, the most logical approach was to readdress Kvale (1996) and the ten characteristics of an astute interviewer. With that being the

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CCBAC refers to the Cariboo-Chilcoten Beetle Action Coalition
base, criticisms will be balanced in practical knowledge of the region’s dilemma and the theoretical framework outlined in chapter three.

Knowledgeable: The practical understanding was well researched on the surface, but operational knowledge of the industry actors processes was lacking. Theoretically, it was an assumption that key areas were addressed, but this is at the discretion of the reader.

Structuring: The questions with various actors were not addressed in a perfectly articulated manner, so reevaluating the perceived understanding of the actors was necessary. This may have been the fault of the actor, but in hindsight, is a criticism of the interviewer.

Clear: It was assumed that the interviewer had total tacit understanding of the actors due to experience in region. However, the communicating of the questions was not flawless in all cases, perhaps a result of the tacit differentials.

Gentle: Allowing for natural conversations sometime took the interviewees to unrelated topics, therefore a criticism could be the fault in letting this happen. In semi-structured interviews, it is a delicate line to walk when letting free-flowing conversations to occur, so this again could be left to the discretion of the reader whilst reading the information through.

Sensitive: Empathy with all actors was not completely consistent due to the differing in the knowledge presented. Therefore, a criticism could be the inconsistencies in the treatment of the interviewees.

Open: Maintaining the professional and academic aura throughout the interviews was a challenge in certain scenarios due to the interviewer allowing things to go off topic. This problem was rendered as more interviews were conducted, but was a fault in the beginning.

Steering: Corrections and improvements were made as more interviews were conducted, but steering conversation was surely a challenge in the beginning. Actors interpreted the questions differently, resulting in conversations to sometimes prove irrelevant for the research questions.

Critical: Probing deeper with questions was minimized throughout the process intentionally in order to prevent personal agendas from fostering. This perhaps was a fault of the interviewer, but a conscious fault at that.

Remembering: The interview guides surely helped in repetition of questions, but a criticism could be that the interviewer did a poor job in avoiding the same answers due to unawareness of potential similarities in questions.
Interpreting: As the process commenced and more experience was garnered, avoiding questions that potentially led to repeated answers was done through interpreting experience. However, the final interviewees were the primary beneficiaries of this increased skill level.
6 EMPIRICAL RESULTS

This chapter attempts to present all of the information gathered from the interviews in an interpretive manner, and do so in a fashion that emphasizes the most relevant information needed for the research question. By the end of the chapter, readers will understand what key pieces of information will be used in the analysis, and eventually what direction the conclusion is starting to take.

6.1 Empirical Approach

The information will be presented in this chapter in a grouped manner (university, industry and government) as opposed to presenting each individually. This is done in a manner where each actor is interpreted as an entity, therefore laying to foundation for analysis at the level of the actor rather than the individual. When the discussion of the actors is being summarized at the end of their sections, the points addressed in the summarization tables will correspond with the italicized sections in the text. The summarization tables have been formatted in the order of the interview guides, so readers may wish to refer to the appendices in order to generate a better understanding for the source of the answers.

When reading through, it should be noted that there are certain key sections that have been drawn out that are not consistent throughout the three actors. The motivation behind constructing the chapter in that fashion is a result of the interpretation process, in that the sections were deemed the most noticeable from the interviews. Obviously various topics would appeal to each actor in a different way, and with this knowledge the presentation would highlight the topics that were most frequently visited and had the most depth of knowledge.

Finally, the empirical information will be interpreted as much as possible throughout the chapter, and understanding the information gathered through the viewpoint of the author is the goal of the study. Minimizing the amount of direct quotes will maintain the hermeneutic epistemology of the study, and the result will be information that is both interpreted and thoroughly understood. The benefits in this approach will be more noticeable once the analysis discussion commences, as key information will be more fluidly transferred into the discussion.

6.2 University Information Review

6.2.1 The Economy

During the first interview, the acknowledgement was made that indeed the timber industry was the primary area of economical concern. Research efforts are continuous in attempts to remedy its reliance, but as it stands, these efforts are independent from the other actors. One area the university is focusing on throughout the research is how to divert jobs into areas other then natural resources, but there are no immediate solutions for this in either practical application or theoretical (McQuarrie). It was stated that the universities “mantra is to incorporate innovation into economic development and develop knowledge based skills” (McQuarrie). Diversification is a motive that stems from the government, but university will play a key role in this process. “From an economic standpoint, diversification is a challenge and that is where the role of science and research can assist all stakeholders of the economy” (Fraser). Diversification funding is “supported from the provincial government level and is definitely a initiative they started” (Fraser). What is important about this comment is the university has been acknowledged as the starting point for diversification (through research) and the funding has been forwarded from the provincial level.

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10 The discussion of ‘government’ from this point onward will pertain to the municipal government that was used in this thesis
Inevitably, industry will be affected through these research efforts; therefore the framework for the helix is emerging through this government initiative.

From the perspective of the university, the industry sector is overtly ‘one-dimensional’ in its thinking, and this leaves a plethora of room to change and adapt to the environmental changes occurring. In the words of the university representative, “the timber industry needs to create more uses for wood than merely building a house” (McQuarrie). Science is seen as an outlet in terms of creating viable innovations that can be used by industry, and “innovation from the university should be used to help industry adapt to change” (McQuarrie). One example given was the discovery of converting wood into ethanol, where the cellulose from the wood is convertible into a renewable bio-fuel. This “was a university initiative that was introduced by the university, but industry failed to respond favorably” (Fraser). In terms of the cooperation necessary to facilitate appropriate and relevant research though, industry and government must be involved in the process, and the diversification initiative is a great opportunity to harmonize the necessary involvement. This cellulose is a great example of potential industry for the region, and the natural development would be “applying the scientific capabilities of university, the diversification funding of the government and the commercialization abilities of industry” (Fraser) – but unfortunately this is not occurring, and innovation is restricted.

In order to attempt sustainable innovation, the university has introduced certain programs, one being Idea Links. “Essentially, how it works is a brainstorming dinner amongst 40-50 handpicked representatives from academia and industry” (McQuarrie). The goal of this event is to induce thinking amongst various disciplines, and what was learnt from the event is “university has many ideas but can’t commercialize them, whereas the industry people have the capabilities to commercialize but are unable to generate the ideas” (McQuarrie). With this example, university is taking the initiative to “break the barriers between academia and the business world, and this is important because the marriage can feed off one another naturally and initiate innovation” (McQuarrie). The deficiency in this marriage is the lack of government representation, and the reason for this is “nobody has been willing to share his or her voice and come” (McQuarrie). Research failures often occur because university and government have shown no firm interest in working together, and this is something that needs to change”. The change is needed in order to create a strategy of innovation, and logically it will be the government who must create this strategy – that should be their top priority (Fraser).

6.2.2 Innovation

The university next elaborated heavily on cultural roadblocks that hinder sustained innovation. From the municipal government level, they reject the university strongly and think that the “university is too arrogant and too smart” (McQuarrie). This rejection of the university from government is due to “suspicious assumptions about motives” (McQuarrie) and while it may be outside of this thesis’s scope, this mirrors “the ridiculous nature of a defensive Canadian” (McQuarrie). Implementing a system of innovation may be a challenge therefore, because government and industry absolutely must change their thinking because the university wants only to be innovative and create, but need to have the right partnerships (McQuarrie). If the university had the opportunity, research efforts would be intensified, but the feeling is “there are too many restrictions due to policy, and only government can change that” (Fraser). While no direct examples of policy restrictions were made, adversely there were no examples of policy being a motivator for research either. The willingness appears to be present, but initiating the process seems to be non-existent and “because you can never pinpoint the exact time of innovation, it is a work in progress so you need to have a constant presence in order to build trust and constantly work towards something. In order to build this trust, they (government and industry) need to give and take as much as we’re willing to do” (McQuarrie).
Another starting point for relationship building between university and government is to remove elements of power, which appear to be an ongoing struggle. “Government sees it to be beneficial to impose any bit of power they can down on us, and that displays reluctances in areas of cooperation” (Fraser). As identified by university, the key to shifting away from resource dependency is working towards a knowledge base, and “government is accountable for this because they have the money and the facilities to initiate this shift through policy” (Fraser). It is not as simple as this, and implementing this shift is a long-term process, but someone needs to be held accountable for initiating the process. It is not necessarily the role of government to be entrepreneurial and risky with taxpayer’s dollars, but they are the key to building a knowledge base (Fraser).

When asked about the universities interpretation of what innovation is, they identified two approaches. “One is new ideas combined with old technology and the other is combining new ideas with new technology” (McQuarrie). The core to innovation comes from ideas, and an increased effort towards idea generation can build around the foundation of technology. Culture once again comes into this equation though. “There needs to exist a culture of thinking and innovation because without that you’re dead from the beginning”, regardless of the technology. The university is working towards a culture of change in terms of innovation, and are doing so by supporting projects such as youth science fairs, chemistry contests, women initiatives, aboriginal science programs – all are designed to get the individuals to think. The thought process behind targeting the individual is to “work towards government and industry changing their mindset through the foundation of the individuals” (McQuarrie). In addition, “we (university) understand that those two actors appear to have an unwillingness to interact and work with us, so we look to other areas in order to develop innovation and idea-generating minds, and that is at the individual level” (McQuarrie).

6.2.3 Incorporating Change

To this point, university has shown a conscious effort to shift the culture of resource dependency towards one of being knowledge based. To do this, “we must push and push through individuals who are willing to stick their necks out and do something. Industry and government show no interest, and the positive change we’re already seeing is more diverse individuals come to us with ideas – this is also in part to our very open door policy” (McQuarrie). Resource based industries have a difficult time approaching the university for cooperation, and part of the reason is “industry looks at university more as a problem-solution center rather then a research base. In addition to the role of the university, “industry rejects academia, perhaps because of our intimidating titles” (Fraser), and this might deter industry from approaching the schools. The role of research is fundamental for what university does, and is the most reliable way to guarantee valid, practical solutions” (McQuarrie). Therefore, the problem does not appear to generate research from the university perspective, but being an appealing option for industry and government is a difficult transition to make. This area of resistance is natural and part of the business, although one area that hinders progress between us is validation of findings. Validation is normal and especially when business and industry invest in our innovative capabilities, so because this is essentially a driver of innovation, we need to be credible and accountable (McQuarrie). The university is perhaps overlooking one area that is easily identifiable, and that is where they prioritize the results of their research efforts. “We researchers have a goal with everything we do, and that is adhering to the academic world and the production of peer-reviewed articles” (Fraser). With that being a priority, the culture of research itself must be re-evaluated in order to produce well-balanced and fair partnerships amongst the three actors. A big part of this re-evaluation process involves perception, meaning, university needs to promote their capabilities and show that the results industry seeks, as well as government, are available through our
research. Changing this perception is a cultural divide, and is a process with a static timeline (Fraser).

There is a unique relationship that does exist between university and industry that could be analyzed further. “Because university is rarely even viewed as an option for innovation, industry would rather come up with innovation and solutions on their own. A lot of the reason points to costs. However, when that fails, we get knocks on our doors” (McQuarrie). The affiliation between university and industry does reveal an interesting characteristic in that “the relationship sometimes extends towards our (university) partnerships and affiliations. We have connections in virtually all fields, so industry sometimes uses us as a connection. Sometimes we act as a hub between everyday people, government and industry” (McQuarrie). A lot of this interaction can be directed back to the open-door policy the university adheres to. “Our open-door policy and partnerships are extremely important to our success. Technology and ideas are what we’re all about and where we’ll continue to flourish. Of course if we had more involvement from industry and government, we (university) have an even healthier business model. Ideas come from all sources and that is what we encourage” (McQuarrie). This relationship also has less to do with funding issues as seen through government as it does with being an outlet. At the same time as having an open-door policy, “university should roll out the welcoming mat more to industry and government in order to increase cooperation” (Fraser). Once again, money changes the research approach and purpose. Personal interest and achieving new, relevant discoveries and inevitably innovation and is the motive for the research efforts, not the money. However, it is a double-edged sword due to the need for money in most cases to carry out the research.

Rural areas within the region offer are viewed as a unique area for innovation, but this is an ongoing challenge for the university, much like industry and government relations. “We try to reach one person at a time, but there is a very suspicious view of the university from everyone. That is why it is still going to be a long process of changing the culture. People cannot look at the university as a threat and realize that ideas and our capabilities and facilities can bring any idea to reality” (McQuarrie). This ongoing challenge should be strongly acknowledged because it again highlights the barrier to becoming an idea, or knowledge, intensive society. When “people have done things a certain way for such a long time, change is very hard. What these loggers think is if I can just cut the tree down and make money I am happy. But the end result may not affect them as much in terms of how it is used, so the innovation involved does not really change their life until the trees are no longer there. That is why it is the youth who we are targeting with this cultural shift - they will be the ones who see the industries demise and they will have to be the generation of thinkers” (McQuarrie). Another issue revolving around the rural areas is “the hunter-gatherer” (Fraser) mentality where if something is not tangible, then it is difficult to comprehend its benefit. With innovation, appreciating the long-term benefits may be difficult initially, but the process has obvious benefits.

6.2.4 Harmonizing the Agendas

Agendas amongst the actors were next acknowledged as a key issue when working towards innovation. Politics and bureaucracy makes achieving innovation impossible. They (government) use that word (innovation) as a buzz term, but for action to actually happen on their behalf – that simply will never happen. They (government) are very, very disconnected. All these actors have preconceived agendas and it will not flow in harmony without a radical cultural shift (McQuarrie). Acknowledging the differing agendas appears to not only be amongst the actors, but as a cultural flaw on a whole. The dichotomy that exists is that “industry does not see that we (university) can be used as a tool (for bringing forth innovation) and government simply does not have innovation engrained in them like we do” (McQuarrie) and this should logically bring the capabilities of the university to the forefront. The agendas also change when funding becomes a motive, or starting point, for research. “There
is an unwritten rule though when it comes to grants and funding that there is flexibility in research unless you are funded. Once your funded, the final product should appease the funding agent – so how you get to your conclusions is not as important as actually getting there” (Fraser). Research bias is therefore a factor, and the effect this has on innovation is the agendas affect the results where they conflict or work together – there is always a change happening regardless.

*Sustainable innovation is ultimately a priority for the university,* and driver of their main agendas. “I (university) wouldn’t be in the business of research and innovative results unless I felt if contributed to establishing sustainability. Building towards better quality of living is done through innovation, and innovation creates sustainability in all factions of life, including the economy” (Fraser). Whether the understanding that increasing innovation through research is viewed in the same manner amongst the actors is a difficult conclusion to be made, but clearly the agenda of the university is sustainability. What is clear though is people need to realize the true value of having sustainable innovation, but as gauche as it may sound, maybe it is necessary to place a price tag on innovation (Fraser). Again, monetary influencers change the outcome of innovation and sustainability, so can be either a driver or deterrent from collection action. This can be directly related to who holds the credit, or the title, for the innovation because if one actor deserves the credit, then the mindset of the helix benefiting everyone is brought into question.

In order for the university to achieve the cultural shift they have discussed, “it is going to come through the small success stories that eventually become a routine: you can’t with the battle until you have small successes. The *reputations of university* will then become viable and a natural outlet for industry and government” (McQuarrie). The sustainability of innovation will be emphasized, “when the economic driver pushed by resources is not there anymore, then innovation must be instilled and failure is not scary to anyone. Change is difficult to accept but it at least must be understood. If you remove the element of fear, innovation will become a routine and if you instill that mindset, then you have a sustainable system that will be a natural fixture within the milieu” (McQuarrie). Once this cultural shift has been made, there are very identifiable characteristics sustainability holds: “the pillars of sustainability include social, economic and ecological aspects” (Fraser). Once those foundations have been built, culture can encompass those three features and a system of innovation can be developed.
6.2.5 University Summary

Table 2 Allan Cole Roberts (2007), University Information Summary

<table>
<thead>
<tr>
<th>Interview Guide Overview – University</th>
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<tbody>
<tr>
<td><strong>Economy</strong></td>
</tr>
<tr>
<td>Diversify into other resources</td>
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<tr>
<td>Economy needs science &amp; research assistance</td>
</tr>
<tr>
<td>Economy needs to move towards increased innovation</td>
</tr>
<tr>
<td>Needs to diversify use for current resources</td>
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<tr>
<td><strong>Innovation</strong></td>
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<tr>
<td>Encourage networking with industry (Idea Links)</td>
</tr>
<tr>
<td>High level of cultural roadblocks in innovation</td>
</tr>
<tr>
<td>See government barriers in encouraging innovation</td>
</tr>
<tr>
<td>Generated from ideas primarily</td>
</tr>
<tr>
<td><strong>Sustainability</strong></td>
</tr>
<tr>
<td>Attainable through credibility &amp; accountability</td>
</tr>
<tr>
<td>Working towards sustainable innovation is the main driver for agendas</td>
</tr>
<tr>
<td>Monetary value on sustainability could shift perspectives</td>
</tr>
<tr>
<td>Pillars of sustainability are social, economic &amp; ecological forces</td>
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<tr>
<td><strong>Triple Helix</strong></td>
</tr>
<tr>
<td>Views government as the initiator of the helix</td>
</tr>
<tr>
<td>Power struggle between actors due to agendas</td>
</tr>
<tr>
<td>University sees these actors struggling to encourage individual innovation</td>
</tr>
<tr>
<td>The healthiest model to achieve sustainability and innovation</td>
</tr>
<tr>
<td><strong>Knowledge</strong></td>
</tr>
<tr>
<td>Knowledge-based society needs to be pursued</td>
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<tr>
<td>A culture of thinking is needed to increase knowledge</td>
</tr>
<tr>
<td>Knowledge as a culture begins at the individual level</td>
</tr>
<tr>
<td>Appeasing funding agents effects genuine nature of the knowledge</td>
</tr>
<tr>
<td><strong>Endless Transition</strong></td>
</tr>
<tr>
<td>Creating a constant presence of innovation starts with individuals</td>
</tr>
<tr>
<td>Lack of trust deters cross-fertilization of knowledge</td>
</tr>
<tr>
<td>Research bias occurs due to funding and motivation from the actors</td>
</tr>
<tr>
<td>Science is not viewed as tangible in rural areas</td>
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<tr>
<td><strong>Research</strong></td>
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<tr>
<td>Research guarantees reliable, valid solutions</td>
</tr>
<tr>
<td>Goal of research is to reach the academic community</td>
</tr>
<tr>
<td>Funding is an issue for project motivation</td>
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<tr>
<td>Personal achievement &amp; research discovery motivates innovation</td>
</tr>
<tr>
<td><strong>Regional Development</strong></td>
</tr>
<tr>
<td>Rural areas present a unique opportunity for innovation</td>
</tr>
<tr>
<td>Culture of the region is adverse to change, therefore difficult to incorporate innovation</td>
</tr>
<tr>
<td>Begins with removing the element of fear amongst the actors towards innovation</td>
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<tr>
<td>Hunter-gatherer mentality prevents innovation from occurring</td>
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<tr>
<td><strong>Networking</strong></td>
</tr>
<tr>
<td>Employ an open-door policy for networking</td>
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<tr>
<td>Are viewed as a problem-solution center</td>
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<tr>
<td>Industry is independent until failure (costs)</td>
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<tr>
<td>High volume of external networks</td>
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Information Overview – University

<table>
<thead>
<tr>
<th><strong>Economy (6.2.1)</strong></th>
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<tbody>
<tr>
<td>Independent efforts occurring to combat timber problem</td>
</tr>
<tr>
<td>Diversification is needed for sake of economy</td>
</tr>
<tr>
<td>Diversification funding available, but not at a research level (lack of cooperation)</td>
</tr>
<tr>
<td>Lack of interest from other actors leaves economy at an economic standstill</td>
</tr>
<tr>
<td><strong>Innovation (6.2.2)</strong></td>
</tr>
<tr>
<td>Apparent lack of interaction between the actors hails idea exchange, let alone knowledge exchange</td>
</tr>
<tr>
<td>A willingness is there to cooperate, but there is a failure to initiate innovation</td>
</tr>
<tr>
<td>Impeding cultural roadblock is present deterring innovation</td>
</tr>
<tr>
<td>Ideas &amp; idea generation is at the foundation of innovation</td>
</tr>
<tr>
<td><strong>Incorporating Change (6.2.3)</strong></td>
</tr>
<tr>
<td>Culture must work towards knowledge-base rather then resources</td>
</tr>
<tr>
<td>Government and industry must view research as an appealing option</td>
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<tr>
<td>Validation of innovation must occur, and starts with trust development</td>
</tr>
<tr>
<td>Youth and individuals are the key demographic targeted to implement cultural shift</td>
</tr>
<tr>
<td><strong>Agendas (6.2.4)</strong></td>
</tr>
<tr>
<td>Need to overcome politics and bureaucracy for sake of innovation</td>
</tr>
<tr>
<td>Preconceived agendas need to be mediated</td>
</tr>
<tr>
<td>Reputation of university needs to change and become incorporated into other actors agendas</td>
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<tr>
<td>Credit for achievement must be alleviated</td>
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6.3 Government Information Review

6.3.1 Economy

The most noticeable theme throughout the interviews with government was a certain vagueness that occurred. To begin with, they acknowledged two problematic areas with the municipal region they govern. First, the actors within the local milieu do not have a common purpose and secondly, the forest industry is declining to the point where it will not be a viable economic option in the near future (Barnett). In order to combat these problems, the local government has taken virtually no steps either through policy or through regulation. “Diversification is a priority for our government, but this will only be achieved through the natural resources we have” (Doddridge). What was
apparent during the interviews was the ability to combat the declining economy would be done so not through innovation, but through reallocation of resources. In order to combat the problem of a declining economy, the government has collaborated with industry in the establishment of a coalition to create sustainable solutions for the environmental disaster. When asked what this coalition will do to combat the problem, the answer was quite surprising. “We are developing 2, 5, 10, and 20 year plans. These developments will be in the form of business plans” (Barnett). Where the surprise lay was when the question challenged the intentions of these business plans, no answer could be provided, no goals were registered and the overall purpose of the coalition couldn’t be validated. “The beetle action coalition is an example of the government at work where we can rebuild the economy” (Doddridge), and while this is a sign of an attempt at change, the structure and strategy for what they are striving to accomplish is vague.

As identified in the theoretical chapter, resiliency is a key element for a sustainable economy, and as witnessed by the vulnerability of this particular region, there are no policies in place to avoid the economic decline. “Our economy is indeed sliding, but in order to revive it, our role is to adjust the funding to other resources we have to work with” (Doddridge). The reliance on resources was quite apparent, “and we are fortunate to be situated in such a resource rich location so we can lean on what we have for economic stability” (Doddridge). However, there was no clear agenda on what alternate resources there were, no explanation on the motives to exploit these resources, and no indication on how policy can create this stability. Resiliency and recovery was acknowledged as a priority for the government, but the mindset to achieve this through innovation was noticeably absent in their strategy.

6.3.2 Innovation

Through the eyes of the government, innovation is new ventures, new opportunities and new challenges. The ability to grasp a challenge and turn that into an opportunity is what innovation is all about (Barnett). When asked about how government effects innovation, the response was bleak. “We really have no policies in place, due partly to the struggle to implement ideas and partly due to the lack of funding” (Barnett). It seemed that the knowledge capabilities of the government was lacking any innovative interest or vision, but “we have the people with the knowledge of where to access ideas” (Barnett). This was somewhat uninspiring, but regardless, the government acknowledges that there are innovative capabilities of some sort within the milieu. In terms of systems of innovation, policy can create such an environment, but for now, they are only worried more about cutting down trees and keeping the sidewalks clean (Doddridge).

Consistently, the power of policy is seen as a driver for innovation, “but we (government) have no guidelines in place because for the moment, we have trees still to drive the economy” (Barnett). This shortsightedness is coupled by the fact that there exists no innovation leader or champion. “There are certainly regional ideas, and some individuals within the region are working with these ideas, but there is no sustainable source of innovation existing” (Barnett). Oxymoronically, the comment on sustainable innovation is the government’s acknowledgement that “policy is the only way to achieve this type of innovation and cooperation” (Doddridge), yet there seems to be no interest in doing so. Within the tested region, government prioritized their efforts “towards getting the necessary amount of votes to stay in power, which means not ruffling voters feathers and avoid drastic change” (Doddridge). This safe strategy will inevitably keep the party in the municipal house, but may have an inverse effect on the strength of the regional economy.

Achieving innovation was a process that the government seemed somewhat unclear about. First of all, they discussed the role of policy having no place in the innovation process, or in the implementation of innovation through entrepreneurship “Our policy can effect the economy through subsidies and alternate uses of resources, but encouraging individual entrepreneurial activity is
not a priority” (Doddridge). Where things appeared a little unclear was when innovation was achieved in the region. “If we have a municipal member making a contribution towards innovation, then government shall be the primary driver of what is achieved. Regardless of whom we work with, we deserve the credit for what is achieved because it is happening in our jurisdiction” (Doddridge). It was difficult to fully understand the fluency in this governmental mindset, but the confidence and vigor of this strategy displayed an adherence to some sort of engrained governmental agenda.

6.3.3 Sustainability

Government stated that “there are a lot of words used interchanged with sustainability: sustainability in the environment, sustainability in the economy, and sustainability in social networks. So the combinations of those things create a sustainable community” (Barnett). In terms of the local milieu, sustainability outside the timber industry was identified in other resource-based outlets (such as agriculture) but there were no elements of sustainability having any connection to innovation. “At present, we do not have the infrastructure for sustainable innovation” (Barnett), however, university certainly does, but is not viewed as a viable outlet for innovative developments. The aforementioned diversification efforts “are currently on our agenda in order to salvage the economy, but this does not necessarily include innovation” (Doddridge). When asked if innovation could indeed be sustained through collaborative efforts amongst the actors of the helix, Doddridge replied, “sustainability can take many forms and we acknowledge the benefits, but this government will not initiate the change. However, we would support a sustainable effort towards achieving an innovative culture”.

6.3.4 Cooperation

Collaborative efforts and knowledge exchange drive the innovation process, but when this cooperation is not present, it is difficult to make true advances. In this region, “the three actors do not collaborate, and the reason why is we compete with each other for idea credit, however, we realize the university is very present in the region and they work here. Just not with government” (Barnett). One explanation offered for the defensiveness in regards to idea credit is the importance for voters to witness their government carrying out change. Albeit this is not a common occurrence, if innovation occurs, the government wants the recognition. While there is no sustained cooperation, the two actors have collaborated in the past “when we (government) went to them with specific research requests, which they granted” (Barnett). The cooperation was limited to government pursuing university, as university never requests anything but money (Barnett). This limits the details of the relationships, so analyzing details such as knowledge exchange is a challenge. “It is impossible to identify the types of knowledge flows or anything else because the cooperation and collaboration is so limited” (Barnett). The noticeable deficiency in the relationship between university and industry with the government is “we do not communicate regularly, although we have an open-door policy” (Doddridge). It appears everyone has this open door policy, but everyone is hesitant to be first to walk through those doors.

Cooperation is impeded once again because of perception between the actors. “Barriers in cooperation begin with the academic world in general because they have problems with both industry and government. They are in a world of their own, and academics have no practical understanding – only academics understand other academics” (Barnett). Government generalized university as being oblivious to everyday matters and industry as being the economic heartbeat, but solely focused on dollars (Doddridge). Considering the position of the government official who said this, it was quite shocking to think that the impressions of this vital actor were so negative. With this impression and the government’s open-door policy in terms of cooperation initiating cooperation may turn out to be quite a challenge. Compounding this notion is the fact that the
“agendas are polar opposite and the power struggle between the parties is extreme because of the need for control. Because of this need for power, that explains why there are always these different agendas. Everybody always wants all the credit, especially university academics” (Barnett). Having a conflict of interest in terms of power, control, credit the outcomes of cooperation truly lays a troublesome foundation for further development.

Interestingly enough, the government realizes that with the inevitable forest devastation, this presents a researchers dream scenario due to the problems needing to be solved. Even knowing this fact, the government does not relinquish to promote specific research, nor do they create an environment where long-term research of any kind can occur. “Those academics conduct research and we know this, but we also know it is through necessity so we stay clear” (Barnett). Furthermore, the view of academia has not entered the cabinet or council meetings in the district “because it is never been addressed as a need and things will just continue the way they have always been here in our municipality” (Barnett). Without considering university as a core participant in the region leaves a plethora of room for growth, but as with any democratic situation, the voice of the people must elect leaders who view the world of academia as beneficial. The problem is that “government should not have to take responsibility for achieving a sustainable economy through cooperation and innovation. The private sector and industry has a framework in place to work around, and if innovation is the result, then that is great. But it is not our job to make this happen” (Barnett). Interestingly enough, all participants within the helix and theorists disagree, but this is the position that the government views upon itself.

Government relinquishes the fact that policy can have an effect on research and development, yet fully concur science can lead to innovation. “We appreciate the contributions university researchers make, but in regards to innovation and economic development, this is an unknown and voters don’t agree with acting on the unknown” (Doddridge). When asked if that could be confirmed through statistics or research, there was no evidence offered other than an explanation of “we (government) just know what the people want, and cooperating with university and industry in this sense has never been prioritized” (Doddridge).

6.3.5 Transitioning Away From Resources

Due to the population and demographics of the region, government needs to direct it is budget towards the most noticeable areas of the economy that people will notice. “It is not politically feasible to invest money where there aren’t a lot of votes” (Barnett) and because the culture of the region has a very straightforward, tangible mindset, promoting innovation may not garner the votes needed for the party. This is an unfortunate reality, but regardless of cooperation and the looming environmental change, government views the immediate needs of the public as taking priority over industry and academic cooperation, which is unfortunate due to the shortsightedness. “Innovation can occur anywhere at anytime, but because we are not a major city, extra-funding will not be provided in that area anytime soon. This is a culture issue, and we have enough problems on our plate to deal with instead of appeasing the university and it is academics” (Barnett). Clearly, the motivations of this government have a set of priorities in place, and it does not include working extensively with university in order to rejuvenate a dieing industry and economy.
### 6.3.6 Government Summary

#### Table 3 Allan Cole Roberts (2007), Government Information Summary

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<th>Interview Guide Overview – Government</th>
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<tr>
<td><strong>Economy</strong></td>
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<td><strong>Sustainability</strong></td>
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<td><strong>Endless Transition</strong></td>
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<tr>
<td><strong>Research</strong></td>
</tr>
<tr>
<td><strong>Regional Development</strong></td>
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### Information Overview – Government

| Economy (6.3.1) | Diversification must happen because forestry is not a foreseeable option | Through a working coalition, economic solutions are seen as more feasible | No policy or strategy in place to promote innovation or entrepreneurship | Being rich in resources is viewed as being enough of a foundation for viability |
| Innovation (6.3.2) | Reverting a challenge into an opportunity is seen as innovation | Believe policy can achieve innovation, but this is not a priority | See regionally innovation as the property of the government due to proximity | See policy in the form of subsidies and alternate resource use as a form of innovation, but do not encourage this |
| Sustainability (6.3.3) | Sustainable communities are built around economic, social and environment stewardship | Sustainability more connected to different resources then to innovation | Lack of governmental infrastructure seen as a problem achieving sustainable innovation | Will support an effort for sustainable innovation, but do not believe they must initiate it |
| Cooperation (6.3.4) | Need for accolades deters cooperation | When government has initiated projects with university in the past, an amicable relationship built | Communication is limited due to the open door policy that is rarely walked through | Very poor perception of the other actors motives for cooperation |
| Transitioning (6.3.5) | Budgets are directed towards areas voters can identify with, not innovation | Immediate public needs take priority over the cooperation with other actors | The culture of change has little room for innovation, according to government | Have an independent approach to diversifying the economy |
6.4 Industry Information Review

6.4.1 Economy

In all the years of service one of the interviewees has given consulting in the timber industry, experience has not garnered him the ability to forecast the events of a diminishing industry. The industry is rapidly being exhausted, and will soon be left with nothing, so essential change is necessary, and the foundation of this change is “capital and ideas” (Johnsson). Modifying the industries focus towards more efficient production of different timber, fir for example, could expand the life span of the industry. However, fir does not offer as many value added features as pine and the market demand for this wood is far lower. Regardless of the wood “the mindset from the industry perspective is trees need to come down quickly, whether its pine or fir, and we need to squeeze all we can out of what we have now” (Johnsson). Consequently, squeezing the life out of an industry “will not allow for value adding companies, or mills to survive, so we need a more innovative approach” (Bramslaven). Clearly, this is not a sustainable approach, but this displays the reality of the industry in that they lack innovative ideas or vision for where they will be 20 years down the road.

The main issue with the industry “is timber should be looked at as an evolving commodity, but our knowledge is limited for enterprising. This is where we need to outsource innovation” (Bramslaven). Part of the reason for limited vision is people in the industry do not have the knowledge or the know-how to adapt to crisis. All industry really knows how to do is produce timber goods from what the forest supplies. Referring back to the fir example, Johnsson explained that the technology does not exist in terms of efficient milling procedures for fir due to its heavy weight, its dryness and the splitting that occurs in the wood during the milling process. So lack of vision is combined with lack of technology, and the result is an industry that is caught in a stalemate. In order to evolve and increase the status of the industry, “re-evaluating our stance on cooperation is imperative, because currently we are (industry) unable to move in the necessary direction due to limited knowledge” (Bramslaven).

6.4.2 Innovation

The role of innovation in rural areas of British Columbia are inspired from a global network of technology, which says that the interdependencies of expertise in the industry drive advancements. “Untraded interdependencies play a huge role in the networking process of the industry, and through these relations innovation has the potential to occur” (Bramslaven). Relying on these networks for innovation is a process that has always occurred within the timber industry, but the interactions have intensified due to the epidemic, albeit innovation in the right areas is not necessarily effective in relation to the solutions needed. “For the pine beetle problem, we see innovations in terms of how to cut the trees down faster and sometimes we have new equipment introduced. But the final product has limitations in terms of innovation” (Johnsson). However, communities of practice globally offer no such solutions for remedying the pine beetle problem, “and that states a problem for our local industry because we lack the necessary innovation, and we’re on an island in tackling this epidemic” (Johnsson).

Unfortunately for this region, they are left with the onus of uncovering innovative solutions, but “because partnerships globally are so embedded and there is an unwritten code of cooperation” (Johnsson), perhaps another region will one day look to how the Cariboo dealt with the issue. At the moment though, innovation is a glaring deficiency in their strategy for the future. The main reason for this deficiency is a reflection on both the industry and the community on whole as there “is a non-willingness to accept dramatic change, even though it is inevitable” (Johnsson). Because both the community and the industry have had such a healthy industry for so long, incorporating diversity and innovation is a process that is not an easy adjustment, and this is a reflection once again of a region
heavily dependent on the environmental resources. The main problem with this resource dependency is “science is restricted, therefore innovation is as well. It is a mentality that is almost archaic in theory, but innovation has never been given the chance to rise to its potential from our representatives” (Bramslaven).

Where the industry appears to be headed now is towards innovating in the direction of other environmental resources. Learning that there is more to life than a sawmill is something that is slowly becoming a reality, although diversification is a difficult adjustment. For too long, “cutting a tree down to make a buck” (Johnsson) has been the main priority, but now the industry is indeed looking towards innovation, although they themselves acknowledge that they may not have the creative abilities to initiate a significant change. Compounding the lack of mental inertia to stimulate innovation, industry “lacks the infrastructure to generate significant innovation” (Johnsson), so venturing outside the immediate industry, or even initiating intrapreneurship, is a challenge. At the core of innovation is “the willingness to venture into the unknown and take on a challenge” (Bramslaven), and unless the industry accepts this change, innovation and a healthy economy will forever be restricted.

6.4.3 Cooperation

This point in the epidemic hasn’t bonded closer ties between industry and university, and industry has done little to extend itself to academia. Potential research, in the eyes of the industry, offers very little in terms of practical solutions and because the priority for industry is to exhaust all of the existing resources, cooperation is very limited. In addition, “enticing fully cooperation with academia is not a job for industry, it is completely up to the government” (Johnsson). If full cooperation between the three actors were to be initiated, the three actors would each have a very specific role in terms of innovation: “industries problems can more easily be accessed by university through governments policy and initiatives” (Johnsson). If this style of innovation system were to commence, a more mutual contribution between government and industry could alleviate some of the financial risk that can sometimes impede the process. That is recognized as the starting point, but “sustaining these efforts should involve giving up some of the strict agendas in place so that the long-term viability of such a project is possible” (Bramslaven). Achieving a sustainable system is embedded in a high level of cooperation, but it is a process of breaking down mantras towards one another (the actors) and moving forward as a collective unit.

In terms of perspectives on the other actors, industry has a very defensive viewpoint. Government, for example, has a constant presence due to “necessity” where the primary contribution to industry is felt through research funding and technology transfers. The problem that industry identifies with government initiated research is much the same as the research efforts university exudes: “there is a lack of immediate, practical solutions and the reason for this is they do not assess the type of innovation we truly need when they’re conducting studies” (Johnsson).

Innovation is seen as an essential key to growth, but there’s clearly a misunderstanding in terms of the industry’s needs and the wants of the researchers. One option explored by the industry is to solely fund university researchers without the help of government, but in terms of innovative solutions, the investment is not seen as an option that would deliver long term benefits (although it is never been attempted, this is an assumption of the results).

Although the industry representatives appeared very shortsighted in their actions and comments, they appear passionately aware of the contributions innovation will make, and where it primarily comes from. “Implementing a strategy of collaboration and cooperation is the only feasible option for this community” (Johnsson), and that means creating awareness between the three parties. Industry refers to itself as “corporate citizens” who merely “go about their business” (Johnsson), but at the same time, they realize the economy role that they play in the milieu. This simplicity leads to a
sense of fear in terms of being dictated to by government, and at the same time, having solutions come from a voice (university) that is not overly familiar to them. Industry acknowledges, “the innovation process between the three of us needs a leader, a project champion, that can harness the various agendas and create an overall benefit” (Johnsson). Inspiring motives and creating solutions is a difficult task, and the job would be “thankless”, but in order for innovative behavior to develop, this must occur. This process “involves aligning agendas, and this would not be possible in our (industry) day-to-day operations, albeit the benefits of innovation is obvious” (Bramslaven).

6.4.4 Sustainability

The initiation process for cooperative innovation “could only be sustained if the champion drives it forth” (Johnsson), and the economic benefits would be delivered continuously by industry. Industries core capabilities include adapting and evolving, but in terms of making the changes and being innovation, that is an apparent weakness in their strategy. With those two contrasting characteristics, sustainability falls outside the vocabulary of the industry, and this statement is unequivocally supported by their actions and efforts in cutting down every tree in sight. The “selfish culture” (Johnsson) that has a hunter-gatherer feel to it has a difficult time adapting to the suggestion that sustainability is an economic outlet for longevity. Unless dollars and cents are involved, the long-term viability of the industry is not a direct concern due to the influx of short-term profits, which is exactly what sustainability attempts to combat.

In order to alter this viewpoint on sustainability, “a cultural shift needs to occur, and it would likely need a strong leader to make this happen” (Johnsson). Spin-offs from the timber industry and innovation are the most identifiable options for a sustainable industry, but acknowledging limited vision and cooperation will inevitably restrict the innovation capabilities of the actors, therefore “something must give or this community is finished” (Bramslaven).
### 6.4.5 Industry Summary

Table 4 Allan Cole Roberts (2007), Industry Information Summary

<table>
<thead>
<tr>
<th>Interview Guide Overview – Industry</th>
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<tr>
<td><strong>Economy</strong></td>
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<td><strong>Innovation</strong></td>
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<td><strong>Sustainability</strong></td>
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<td><strong>Triple Helix</strong></td>
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<td><strong>Knowledge</strong></td>
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<td><strong>Endless Transition</strong></td>
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<td><strong>Research</strong></td>
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<tr>
<td><strong>Regional Development</strong></td>
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<td><strong>Networking</strong></td>
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### Information Overview – Industry

| Economy (6.4.1) | Change is occurring by necessity, with the direction moving towards capital & ideas | Industry is focusing on squeezing profits out of what is left, but acknowledge change is occurring rapidly | Innovative approaches are needed for extending the economies lifecycle, but industry lack vision to do so | Limitations in enterprising behavior with timber due to limited knowledge base |
| Innovation (6.4.2) | Traditional innovation sources for innovation are limited do to region specific problem | Innovative solutions for the usage of the wood are not being developed as result of limited knowledge | Embedded partnerships from the past are calling for a cultural shift in cooperation toward innovation | Have little in the means of a strategy for entrepreneurship, therefore calling on an innovation champion |
| Cooperation (6.3.3) | Great willingness to cooperate but little effort in stimulating the cooperation | Believe they are the sole bearers of financial risk in research which is a deterrent in cooperating | Cooperation must be guided by a mediator in order to build trust and validity | Cooperation begins with breaking down independent mantras and agendas, then working as a unit |
| Sustainability (6.4.4) | The sustainability of an innovation system can only be achieved with a champion, or leader | Regional economic stability is driven by industries use of new innovation | Sustainability is not an area of emphasized importance, and incorporating a strategy to combat it needed | Economic and innovative stability must begin with a cultural shift |
7 INFORMATION ANALYSIS AND DISCUSSION

The analysis and discussion will bring together the information formulated in the theoretical chapter as well as the information discussed in the empirical chapter. The generation of a conclusion will begin to take noticeable shape by the chapter’s conclusion, and there will be a clear line linking the differences and similarities between the theories and the information.

7.1 Approach to Analysis and Discussion

The format for analysis will mirror the stages set out in the interview guides. Acting in accordance with the guide will allow the cross-comparison between the actors to have structure and reason. For referral to the specific questions being answered throughout the analysis, reviewing the interview guides in the appendices may assist the reader at this stage. Due to interpretive approach of this paper, the information collected will be applied in the most relevant manner when cross-referenced against the theories discussed in chapter three. This will allow for verification or falsification of the theories, where the research questions will be answered in the conclusion.

7.2 Economy

Before incorporating the theories into the analysis and discussion, it is important to understand the perspectives the actors have on the regional economy. Because the practical problem of the study affects them all interdependently, relating their understandings on the most vulnerable areas is vital. The university viewed the dilemma facing the region as a situation where the incorporation of innovation would salvage the economy through diversification. Government shared this view, although they questioned the viability of the diversification efforts in retrospect with the knowledge capabilities of those incorporating that changes, or in this case, the diversification efforts. The diversification efforts were unequivocally a top priority for the government, and they emphatically emphasized that the decline of the regional economy needed to incorporate changes to the resources of the region. Diversification of the economy was not as vital to the industry actors, although they had made modification in their strategy towards the changing environment. However, they were clearly not in accordance with the other two actors in this regard. While diversifying the economy was outwardly pushed from the university and the government, industry viewed the necessary efforts more from the short-term perspective in that exhausting what resources remained.

The viewpoint held by each actor as to the sources of economic stability in the region were clearly out of equilibrium with one another, and this effects the approach to implementing the system of innovation. Because the issue of sustainability directly relates to the harmonized cooperation, the actors may not fair well in cooperation because of the outlook on the economy. An “articulated consensus on what to develop, what to sustain and for how long” (Parris 2003, p 2) must be present for anything to be sustainable, but the initial starting point for this to occur needs to be a common focus. When addressing where the vulnerable areas of the economy were, the actors had three very different outlooks. For example, the three actors identified the following issues, as being at the focus of the vulnerability of the economy, and it exemplifies where their focuses are on the state of the economy and the direction it should go. In order to connect these points to theory, included with each piece of information will be a countering point that will direct the argument towards proving the unsustainable viewpoint the actors have on the economy.

University: We need “to divert jobs into areas other than natural resources” (McQuarrie)
“From an economic standpoint, diversification is a challenge and that is where the role of science and research can assist all stakeholders of the economy” (Fraser)

**Sustainable Definition**

*Sustainability represents a novel and radical departure from the past – Tate, 1994*

**Reasoning**

This definition of sustainability confirms that the university accepts they must make changes in order to regain sustainability, and they refer to this as diversification.

**Government**

“They the forest industry is declining to the point where it will not be a viable economic option in the near future” (Barnett)

“Diversification is a priority for our government, but this will only be achieved through the natural resources we have” (Doddridge)

**Sustainable Definition**

*Sustainable development… calls for more effective use of existing resources – Karapetrovic, 2007*

**Reasoning**

Government addresses the future of the economy as redirecting the resources that will remain after the timber is no more, therefore confirming development will derive from effective use of current resources.

**Industry**

“The mindset from the industry perspective is trees need to come down quickly, whether its pine or fir, and we need to squeeze all we can out of what we have now” (Johnsson)

“Timber should be looked at as an evolving commodity, but our knowledge is limited for enterprising. This is why we need to outsource innovation” (Bramslaven)

**Sustainable Definition**

*Sustainable development is… better ecological performance – Dawson et al. 2006*

**Reasoning**

The industry is neither sustainable nor thinking with longevity, therefore will have difficulty incorporating change independently. Therefore, better ecological performance, as well as involvement, must be the starting point for change.

The motivation behind addressing the points in this way is inspired from the definitions of what sustainability is, as well as the importance of building from a point of understanding amongst the actors (Etzkowitz 2002). Building from this point of understanding is fundamental in moving towards change, and by showing the points in this fashion the disconnection begins to become clear, and the actors confirm that their approach to the economy is not sustainable at this point in time.

To summarize further, the university have clearly directed their attention towards where the economy needs to go and how they can contribute in the efforts to get there. This is a long-term,
sustainable outlook, especially when compared to the industries shortsightedness. Exploiting resources remains their number one objective, but the potential for collaboration is present through the identification of outsourcing innovation. However, they are most definitely not approaching the environmental change with any inspiring sustainable initiatives. Government, in this scenario, has a strategy that is closely harmonized with the university in that they acknowledge the necessity for diversification. The only deficiency in their strategy is the lack of cooperation, or desire for cooperation. The economic standpoint between the actors shows signs of potential, but at the moment, they are approaching their strategies with complete independence and are lacking the vision to work with the potential partners around them. Based on these standpoints, the theory presented by Etzkowitz and Leydesdorff (1998) where the spirals of innovation between the actors cross-fertilization one another would be falsified based on the fact that they are acting linear to one another instead.

Bringing out these issues of the economic perspectives to begin this chapter was a conscious decision, and the inspiration for this decision stems from the first theories introduced in the thesis. Within the theory of panarchy and growth, Holling (2001) identified that the relationship between the environment and mankind creates diminishing economic benefits when altered from the natural growth cycle. This metaphor is relevant here because the economy is experiencing the same diseconomies of scale, and in order for an invert change to occur, the actors must shift their perspectives so that they are approaching the change in the same manner. Included in the panarchy metaphor was the concatenating problems that occur when striving for a sustainable system (Tainter 1998), and the effect that these problems have on growth. The information gathered from the actors is in themselves examples of concatenating issues that hinder the growth of the economy. The main economic issues expressed by the actors shows that the focuses each have on the state of the economy reveals key information about their approach to change, and not conducting the change in strategic equilibrium will not enhance growth. Therefore, the disequilibria from the outset of creating a system of innovation is essentially acting as a concatenating issue that will need to be addressed in the formulization of a strategy for achieving sustainable innovation.

7.3 Innovation

The importance of networking was heavily elaborated on when the issue of cooperation was addressed in the information collection. Industry confirmed that their primary source of innovation was from the networks of practice they are involved in, although partners outside of the industries network seldom collaborate with them. The failure for industry to work towards innovation is primarily a cultural mentality, and all the actors confirmed this characteristic. Because the regionalization of an innovation policy relies so heavily on the varying social and cultural conditions in the milieu (Asheim & Isaksen 1997), the process of change starts with thawing the communication channels between the actors and breaking away from the perspectives of the past. Etzkowitz (2002) addressed the process of thawing communication channels as “the development of reciprocal relationships and joint undertakings”, and this process was “specific within regional contexts”. The purpose of bringing the issue of communication channels is the direct relation it has with producing innovation, and the need to break away from traditional courses of action. Innovation is a process that all the actors viewed as a difficult stride away from the comforts of past processes; therefore the starting point is to better understand the formal and tacit processes involved in harmonizing the agendas. In order to implement this system of innovation, bringing together the major players in order to inspire innovation as a “territorial phenomenon” (Asheim & Isaksen 1997, p 314) that starts with the opening of communication channels, and while this is a very difficult starting point, it has the advantage of being “facilitated by geographical proximity” (Asheim & Isaksen 1997, p 317). The
advantage is the fact that the actors are so directly affected by the practical problem of the beetle kill, and therefore communicating the need for innovation is simplified.

The first challenge to overcome in the process of innovation is challenging the government to allow for policy to encourage innovation. Currently, no such framework is in place, and because appropriate regulations push regional actors towards collaborative innovation (Etzkowitz & Zhou 2006), it is imperative to initiate this process. Mirroring the cultural restrictions that industry has in terms of collaboration, government needs to bring forth a lateral approach to change that takes them outside of their typical agenda of independency. In successful developments of systems of innovations, the government inspired the creation and implementation of an innovation strategy (Etzkowitz & Zhou 2006), but this movement is not occurring in the pine beetle scenario. In fact, the priorities of the governing party towards innovation are embedded in retaining votes through safe policies. This creates a difficult situation then, because innovation must have an element of risk-taking, and if the government is primarily concerned with the short-term and garnering votes, then policy and innovation may not work together as stated in theory. The element of risk-taking is woven into Galbraith’s (1996) definition of innovation where the invention and application of new ideas must occur, and with any process entering the unknown, there exists a percentage of risk involved. Overcoming this risk is where the entrepreneurial spirit must act as a driver, or motive, in order to achieve the end result of the new idea, which incorporates Feldman and Francis’s (2004) identification of entrepreneurship needing to be present in the process of innovation.

The question that next needs to be addressed is how to overcome these cultural roadblocks (McQuarrie) that are displayed by government and industry. Enhancing innovation from the individual level is a possible starting point for a cultural shift, as stated by university. The definition of innovation created in this thesis pointed to the tacit, or regional, knowledge flows that stimulate innovation, and this needs to start at the individual level, and the long-term result is a culture of thinking. University has an efficient model for creating this culture of thinking and innovation, and this is confirmed under the theory of de-contextualization of knowledge flows. “The process of generating useful contextual knowledge, once garnered, begins with the de-contextualization of knowledge” (Albertini 1999, p 111), and this process has been identified by the university as the starting point for the culture shift in innovation first at the individual level, which then leads to the regional level. If breaking down the existing knowledge to its core and then rethinking the process of using this knowledge is a step towards increased cooperation, then relationships must be re-developed and that could prove to be the foundation for innovation.

What was never in question throughout this research project was what innovation was, but what undoubtedly occurred was the question of how to get there. The research question in this thesis asks how a system could be implemented, and one suggestion begins with breaking down relationships, which establishes a network of cooperation amongst the actors. This scenario of reworking relationships and priorities is not situation specific due to the fact that networking with the specific intention of achieving innovation must occur in all situations. To this point, this particular issue has been highlighted in the findings of this report, but can be parlayed to all implementations of an innovation system. Etzkowitz (2002) defined this as “economic redeployment”, and that term can be coined to the redevelopment process in this milieu.

7.4 Sustainability

Innovation systems have been identified to this point as needing a chorus of efforts, or “joint undertakings” (Etzkowitz 2002), in order to be effectively developed, but the imperative element needed for it to be sustained is a champion to guide the efforts. There is a deficiency in research parlaying to this subject, but the empirical findings constantly reiterated the importance of this
element. Industry identified this as a thankless job, and immediately pointed at the government as being the source for commencing a project such as this. University also directed the sustainability of such a movement towards the government, and both the university and industry discussed their independent agendas as being the root for the unwillingness to motivate a system. Independent agendas could strengthen the whole system through a championing body if that body could incorporate the understanding that the helix is in a constant state of evolution and is a static system (Saad & Zawdie 2005), and knowledge flows, regardless of the agendas, only strengthen that system if sustained.

The identification of a mediator in the implementation of a sustainable innovation system is a particularly crucial issue, and this is confirmed in the mediation of knowledge flows. Brown and Duguid (2001) identify the certain types of knowledge are acquired in various processes, either being ‘sticky’ or ‘leaky’, and if these barriers to exchange within a network exist, then innovation will not occur. The topic of sustainability within the system is definitely heightened when a system champion can mediate amongst the actors in the process of information exchange in order to make sense of the information being relayed. The actors all discussed their core competencies being hindrances in the cooperate efforts between them, but they also confirmed that if there were a element of trust developed between them in the form of a mediator, then cooperation would not be a problem. The issue of trust is a driver in sustaining efforts and this calls for a mediator amongst the actors, likely a party or individual with vested knowledge in all three of the actors. The issue of trust issues with knowledge is closely tied into Zeigler’s (1985) issue of “fissioning”, wherein knowledge is withheld due to its unusable nature outside the core users and assumed irrelevance outside the main user of the information. If a mediator were used, then fissioning would effectively convert the knowledge into a more usable form, deeming it more useful to the other actors, and innovation could thrive.

In order to generate sustainability for long-term innovation, it is imperative to also consider how to motivate the actors to cooperate for a sustained period of time. The limitations in innovation potential can be based in regional capacity, and this occurs when core capabilities and intelligence is prevented from flowing. Asheim and Isaksen (1997) conclude that geographical proximity could restrict the level of innovation as much as it can drive it, and this is why the networks involved must be sustained for the longevity of the cooperation amongst the actors. The creation of a new network, the helix configuration, adheres to the idea that cross-fertilization of knowledge benefits the actors on a whole but also at the actor-specific level, but due to the geographical closeness of the actors, stalemates in idea generation is inevitable. The remedy for this stalemate is the continuous fertilization of pre-existing relationships, and if these two processes can be occurring simultaneously, then the system of innovation can be sustained.

In terms of comprehending the necessities involved in working towards sustainability, university had the most pragmatic definition. In order to work towards a sustainable economy, considering “social, economic and ecological” (Fraser) aspects must be present, and the research done at the university incorporates those factors. In terms of this thesis, these aspects are important to address due to the environmental implications of the practical problem. What the university has identified in the environmentally changing region is a deficiency of research done in terms of diversifying the natural resources of the region (Fraser), and in order to generate the sustainability that is desired, there are two foundations striving to achieve this. One is the scientific research that has become routinized (Yin 1979) into the curriculum of the university. But the second is “encouraging workers into areas outside resources” (McQuarrie), and this is being achieved through an economic development strategy that depends on innovation. “Diversification acknowledges that resource-based economies will always look to the environment for sustainability, but incorporating innovation into economic development” (McQuarrie) will allow
for economic development outside of the core regional competency. The importance in addressing this is because it displays an acknowledgement by the university actor that there is the need for change in the culture of learning. “Being one-dimensional in (our) thinking” (McQuarrie) has created boundaries in sustainable economic development in a time of environmental change, and addressing the need for change is the first step towards the implementation of an innovation system.

Within the universities’ pillars of sustainability, they have effectively incorporated the theory of routinizing their process of delivering beneficial outcomes. The focus of academia to build towards innovation through these pillars offers a constant outflow of research, but where the problem occurs is they do so independently. The university looks to “change the culture of thinking” (McQuarrie) due to the need for adapting a more resilient economic infrastructure, but conduct this in an isolated, perhaps misdirected, manner. “Neither industry nor government feel inclined to share their voice to us (university)” (McQuarrie), therefore leaving the university to conduct research in an inefficient manner. “Reluctances in key areas of cooperation” (Fraser) between the actors are occurring in this particular region, and this causes disequilibria in terms of working towards sustainable innovation.

A key motivator in the empirical findings was to come to an understanding of what sustainability meant to the actors in order to better understand the direction they work towards to achieve this. The biggest anomaly in this identification effort was the university and their very theoretical explanation about the pillars from which they work. Industry had no strict sustainability policy, and government never actually gave a clear definition. These findings are connected directly to the theories of resiliency and adaptation, as they connect to the feasibility of creating a sustainable system. In essence, sustainability encompasses both change and longevity as an engrained process, so in order to create these characteristics in a harmonized fashion amongst the actors, they must re-evaluate the cultural framework from which they view one another. If the industry works in such an unsustainable manner and the government clearly works within a short-term framework, then communicating the benefits of sustained practices appears to be the onus of the universities. The pillars of sustainability are well aligned with the characteristics of sustainability outlined in section 3.2.1, so it can be stated that the responsibility is on the other two actors to work within these frameworks should this system of innovation be implemented in their regional milieu.

The measurable characteristics of sustainability were outline in section 3.2.2, and adhered to Sheirer’s (2005) key findings of what a sustainable system should entail. When cross-evaluation versus the information is conducted, it is safe to say that a new agenda must be routinized into the collaborate efforts in order to implement a system of innovation (Yin 1979). Based on the findings, the elements Sheirer identified are clearly lacking in the efforts to be sustainable by the actors, but this can be viewed as a starting point in the implementation of an innovation system. Clearly, identifying an innovation champion for the region, and more specifically the helix, has been confirmed as the first step (Karapetrovic et al. 2007). All three of the actors made mention of a mediator-type role being necessary for an innovation system to be viable, and after that, the process of routinization must accept sustainability in the process. This connects to the topic of cultural roadblocks, and a mentality shift, but once achieving this process, it is feasible that the next shift will be away from such strict resource-reliance. The necessary shift in culture, identified as a must in the implementation process by the actors, confirms Karapetrovic et al. (2007) assessment that the success factor in integrating sustainable development must have someone champion the leadership role. The next step in taking on this role of leader is to engrain the routinization of innovation (Yin 1979), and if this is accomplished, sustainability of the system is far more feasible.
7.5 Knowledge Flows

One main area of resistance observed in this particular helix configuration was the flows of knowledge sent between the actors, and the effects this had on their independent agendas. As identified by Albertini (1999), codified knowledge has the potential to flow between autonomous actors with a lower level of misunderstanding than contextual knowledge. However, the scenario between these actors is that the knowledge is primarily embedded within their specific processes, which means the information is not as useful to the other actors. The idea of the helix is to have the cross-fertilization of knowledge benefit the actors through the development of innovation (Etzkowitz & Leydesdorff 1998), but when the starting point for understanding the knowledge is not present, then the knowledge becomes lost in translation. Based on the empirical findings, the implementation of such a system needs to be built from the base up, and that means creating an environment where the “input/output relations” (Etzkowitz & Leydesdorff 2000, p 20) are allowing for the most beneficial information to be exchanged, therefore adhering to the neo-classical stance on science mentioned in section 3.4.3.

Another consideration with knowledge flows is the effect this has on the independent agendas the actors have. For example, the flows and cooperative efforts between university and government were viewed either as bureaucratic obstacles or as political motivators, depending on the perspective. Why this is relevant to knowledge flows is it exposes the static nature of the helix based on the independent agendas of the actors. Saad and Zawdie (2005) concluded that the evolving and changing agendas of the actors was the cause of a static helix, and that was supported in the empirical information collection. Therefore, the implementation of the innovation system needs to address the needs of the actors independently in the development stage, where the output of their efforts, the innovation, creates a situation where the knowledge development builds inertia for the overall benefit of the region. The reluctances that were presented by university occurred for some very identifiable reasons. To begin with “the imposing of power struggles” (Fraser) between the actors in research projects resulted in a hesitation to cooperate further. These damaged ties in this region would need to be mended should appropriate knowledge flows occur. Knowledge flows are a key foundation for a functional innovation system, and when these are ‘sticky’ amongst actors, a failure to derive results occurs. The next area of resistance was the overall perception that was felt by the university. “They (industry) look at us (university) as more of a problem-solution center rather then a research base” (McQuarrie), and this misinterpretation stems even further. “Industry looks at us (university) as though we have horns, and often suspicious assumptions about our motives to conduct research kills the innovation process we are trying to achieve” (McQuarrie). How this can be interpreted is the agendas of the actors are not fully understood and with negative impressions of the motives behind research, this clearly not a foundation for collaborative efforts.

Building towards a knowledge-based society is a process heavily engrained in the culture of the region, but another key characteristic is the issue surrounding credit and acknowledgement. All the actors mentioned receiving accolades for achievements as an important element to participation, and it became very apparent that garnering respect through independent action was an issue. How this effects the implementation of the helix is the high level of resistance to cooperate that will occur when the actors view the benefits of the helix not as an overall benefit, but rather co-dependant beneficiaries where the appropriate recognition is not necessary to be given (Saad & Zawdie 2005). The government was adamant in that they deserved all accolades for successful advancements within their jurisdiction, regardless of whom carried out the accomplishment, simply because of the proximity of the achievement. Needing this recognition was mirrored by academia in the form of scholarly articles for the academic community. The issue to be raised here in theory here is Etzkowitz and Leydesdorff’s (1998) statement that actors
within the helix must first understand that the cohesion between the actors must be constructed in a manner where the overall benefits of the cooperation may stagger between the beneficiaries in terms of credit recognition, but as a whole, the innovation is generated for the whole of those involved.

7.6 Endless Transition

Embedded within the helix model is the connection between science and innovation, and the necessary characteristics noted in section 3.4.4 (Etzkowitz et al. 2005) were as follows:

1. The transition in relationships towards applied research, basic research and product development, and how the boundaries between the elements are being lifted and the three phases are working together.
2. The transition in the cross-fertilization of knowledge between different industries and disciplines in order to create interdisciplinary collaboration.
3. The transition working towards the ideology of the helix where the actors work on an endless transition towards innovation rather than journey towards an ideal model of knowledge.

Whilst interpreting the first issue mentioned, the empirical findings were quite bleak in terms of these relationships. The university was heavily motivated to conduct all three types of research, although the motivation had an exclusive audience. While attempting to implement a system of innovation, the innovation must include the research efforts of the university but notwithstanding, the process of harmonizing these efforts with the other two actors is essential. That being stated, applied research, basic research and product development needs must be synchronized in a matter where there is an ongoing presence. University has embedded these three points into their efforts, and has consciously worked in this matter due to the fact that the exact point of innovation is nearly impossible to pinpoint (Fraser), therefore the efforts must be constant. The main deficiency in the findings was the efforts of government and industry were almost non-existent, and this would then lead to the conclusion that initiating this process may stem from those two actors, and must be carried out by university.

The next point in the endless transition model was the need for a cross-fertilization of knowledge to occur, and as discussed in the innovation and sustainability analyses, this process is a difficult one to achieve. The first hurdle that needs to be overcome in order to achieve this particular innovation system the implementation of a mediator of sorts, because it appears the communication channels and knowledge flows between the actors are quite restricted. In order for interdisciplinary collaboration to occur, there needs to be an open line of communication and participation, but because these actors appear to be working completely independently, the perspective and approach to knowledge sharing needs to drastically change. For the sake of the research question, there was a positive discovery in terms of creating a flow of knowledge exchange and that is seen in the openness the actors have to collaborating. University, industry and government all adhere to open-door policies, which states there is a willingness to work together. In order for these different disciplines to feed one another, being open to change is necessary. The issue that would next to be discussed is whether or not the actors would indeed carry out these thoughts in reality, because stating this openness and actually doing it is questionable.

The third point in the discussion was perhaps the most encouraging when interpreted from the findings of the university. Within their strategy for innovation, university has identified that it needs to be an ongoing process and part of the culture of learning, or routinized (Yin 1979). This approach to knowledge supports the endless transition model due to the fact that the university acts under the guise of an ongoing process without a set destination. In order to implement a system of innovation and maintain sustainability, this is the approach needed by all the actors.
Therefore, communicating the perspective of the university to the other two actors is necessary in the startup process, which again puts more responsibility onto the university. Because industry has a very sublime approach to change, it appears that their contribution to the implementation of the model will be the practical application of a lot of the findings, not the initiating. The same can be said for government in some respect because they truly have a safe mentality due to their affiliation with the citizens of their jurisdiction. Consequently, university’s responsibility to educate and shift the perspective on knowledge and change is heightened because of their current strategy of embedding innovation.

The role of science that is portrayed in this thesis has two main issues that need to be brought together. First of all, research has been motivated differently by all three of the actors, and this has an effect on the timing of research and for what audience receives it. Research is fundamental in the innovation process, and most noticeably in the efficiency of the helix model. With that in mind, the university needs to lead the process as they are doing, but having university and industry incorporated more closely into their efforts needs to occur. The second issue is the cross-fertilization efforts. This has already been elaborated on to some degree, but the important role that it holds in the innovation process has a relationship with the endless transition, and this is not occurring in this particular milieu. In order to create a conclusion for this research project, what needs to be developed is a system where the knowledge between the actors cannot only be transferred with ease, but the process must be sustained and avoid falling into the evolutionary economists viewpoint where actors act as “specific and bounded carriers of an innovation process” (Etzkowitz & Leydesdorff 2000, p 15). That will deliver a sustainable system, but the cultural obstacle that must be thawed turns the implementation of such a system into a long-term process of change. Overall, the theoretical findings do bring out the deficiencies in shape of research in the region, but the problems can be overcome, and part of this solution is found in the openness to change that the actors portray.

7.7 Push and Pull Factors

7.7.1 Academia

Aside from the goal of producing scholarly works for the academic world, academia works vigorously in attempts to diversify industry through innovation. More specifically in the tested region, academia has acknowledged that environmental changes will make it mandatory to diversify, and these findings confirm the outward push for academia to further technology and seek new industries. Etzkowitz and Klofsten (2005) discussed this as a process where universities produce knowledge that is transferred into economic activity, or change, and the stimulation for doing this comes from problems in the local milieu. Knowledge and science are the obvious contributions that academia produce in their efforts, but in order to answer the research question in this thesis, the motivation for doing so needs to be considered. First of all, the attempt to be innovative was stated to come from ideas, reapplying new ideas with old technology as well as new, and identifying problematic areas within the economy (Fraser). This is a big part of the university-actor’s agenda, but undoubtedly this confirms that during the course of regular action, the outward ‘pushes’ contributed by academia are thus in accordance with their role in the helix.

With problems, or knowledge deficiencies, pulling academia into the fold of the economic setting, this verifies another goal of academia in that they thrive on researching into problems within the environment. The problem with this approach though is incorporating the main issues faced by both government and industry. Rather than working towards filling the voids in knowledge experienced by industry and government, university themselves identify areas for research activities in the milieu as a whole. Correspondingly, the university indeed provides research for problems at a regional level, but this is not the most efficient conduct when working
towards an overall system of innovation. Both theoretically and practically, the pull factors that influence the university is fundamentally aligned, but in order to answer the research question in this thesis, these pull factors must be reassessed. What needs to be considered is whether or not motivating research in the current manner can be reworked so that the industry and government pull the university more vigorously into their strategy, and if this can be achieved, the result is the potential for a higher level of innovation to occur.

7.7.2 Government

The main factors that push the government towards contributing within the helix model are primarily based on policy issues. Regulations and policy making are stated as the premier factors that government can directly influence, but in the empirical findings of this study, that theory is not supported. This particular government offers no such motives for either the university or the industry to be innovative, and the reason for this is the risk involved in the process.

In the Koistinen (2000) example used in chapter three, the government made structured policy decisions that never put the economy in potential distress. Inversely, this example showed how changing the direction of the economy can be achieved through calculated policy, and this also showed governments ability to redirect resources in a milieu. Being so embedded on resource-reliance has created a strong resistance to change for this government, so in order to implement a system of innovation; it may need a change in government to make this happen. That is outside of the scope of this thesis, but in reality, that may be the solution. However, the push factors that the government can control may have to start with the involvement of the other actors in their policy of innovation. This is not such a drastic alteration from their current practice, and evidence for this is the involvement they have with the Beetle Action Coalition. In essence, this is an example of the government’s ability to collaborate with industry, but this particular coalition has little motivation to be innovative. This does not make the reality of an innovative future very positive, but rather suggests the government does show intentions of collaboration.

What should be happening, but currently is not, is the government should be acting as a stable entity within the region it governs in terms of initiating change. In order to create a system of innovation, a reevaluation of the government’s position on innovation needs to occur, and the motives definitely need to change. This particular government states that they view sustainable innovation as an economic driver, yet they have no policy in place to initiate the movement away from being resource dependent. Within the push and pull framework, government is stated to hold the title of initiator in encouraging linkages between the actors, and to this point, this particular government shows no action in doing so. Yet, they are adamant that these linkages hold the key in achieving sustainable collaboration. This deficiency in action again points to the culture of change that needs to occur, but looking deeper into why there is a deficiency in knowledge creation directs the discussion to the topic of motives. At the moment, finances, resources, and social elements are all pointing towards the need for innovation, so the fact that this is not occurring is rather obtuse. Therefore, identifying the motives behind politic agenda should be included when discussing pull factors for government’s involvement in the innovation process.

7.7.3 Industry

Industry has a self-confessed deficiency in knowledge creation and development, and this component puts the main push factor of industry in accordance with the helix model. The industry has identified that their strategy is rather self-fulfilling under the current state of the environment, but it is very encouraging to note that they welcome the contributions of academia in terms of innovative solutions. The only issue that should be summoned is that industry has a
complete willingness to work with the world of academia, but they identify that government is responsible for making these ties occur. Theoretically, such a direct onus is rarely discussed when bringing up the starting point of an innovation system, but it seems quite clear that the position of industry is to cooperate, but not initiate such a process of change. The theories discussing the extent of cooperation often overlook the initiation process, although it appears that pushing the cooperative efforts from industry are motivated from a sense of security and trust that can be instilled through the efforts of government. This trust issue was discussed briefly in the sustainability and innovation sections, but again it needs to be recognized as an antecedent in cooperation from the viewpoint of the industry.

If the process of innovation were to have a primary beneficiary through the development of new technology, then it surely would be the industry. Both theoretically and practically, industry is viewed as the end user for most developments, and this increases the demand for new developments from the industries perspective. One key factor in these developments is where they are coming from and to what degree they are sustained. The empirical findings revealed that industry orchestrates most of their networking with other industry representatives, and this speaks to the network of practice they work within. Increasing the contributions of a regional innovation system into their strategy would undoubtedly increase the feasibility of extending the life cycle of the industry, but altering their perspective on the other actors would prove to be a difficult act.
8 CONCLUSIONS

The purpose of this chapter is to formulate clear conclusions for the research question offered in chapter one. The conclusion chapter will be divided into two sections in order to clearly answer the duality of the question.

8.1 Research Question Review

How can a system of innovation be developed within an environmentally changing region, and what can the actors within this system do to secure its sustainability?

8.2 Developing a System of Innovation

8.2.1 Identifying a System Leader

The first step in developing a system of innovation involves identifying a system leader whom can act as a mediating body for the actors. The primary characteristic that this figure must possess is a vested understanding of the strengths, weaknesses and general purposes behind the involvement of each actor.

The actions carried out by the mediator will include the following fundamental roles:

- The mediator shall guide the cross filtration of knowledge that will occur between the actors will be guided in a manner so that the most relevant knowledge will not only be exchanged, but thoroughly understood, and this will result in the innovation process acting with far more efficiency
- The mediator will be viewed by the actors must view the role of as a source of trust in order for full cooperation to occur, and this trust should also be a source of motivation to collaborate
- The mediator shall motivate the actors to cooperate in the development phase of the system, but the shift from initial motivation towards routinizing the process is a vitally important responsibility of the mediator
- Once routinized, the mediator must guide the strategy of the actors in a manner so that an open-door policy to not only exists, but becomes functional and relevant through routine usage

8.2.2 Developing a consensus amongst the actors

Once the mediating figure has been identified, the next step in the implementation of the system is developing a consensus amongst the actors in terms of what the purpose behind the cooperation is, and how to carry out the process.

The reason for reaching this consensus, and the process in doing so, are as follows:

- A consensus secures a foundation of resiliency to the system by limiting detrimental concatenating issues
- Actors within an innovation system must approach the process from a common platform of understanding and reason
- The development begins by orchestrating the agendas in a manner so that the innovation benefits both actors exclusively and the system as an entity
- Balancing the roots of action in strategy formulation will give the system focus and direction
- Consensus will alleviate the need for recognition and accolades amongst the actors due to the understanding that innovation is a benefit all stakeholders in the region

8.2.3 Overcoming Cultural Roadblocks

The final stage in the development of the system is overcoming cultural roadblocks in relation to knowledge and communication.
In order to overcome these hurdles in culture, the following elements must be incorporated:

- A process of de-contextualizing knowledge, which is made possible by reevaluating the relationships between the actors and by opening the channels of communication (perhaps through the mediator)
- First generating an agreement for collaboration, and then routinizing the process of cooperation
- The routinization of innovation must work towards a culture of ongoing innovation through the knowledge exchanges, as opposed to a culture with a fixed-point in time for innovation to occur
- Diversifying the thought process away from resource-dependency towards a culture of knowledge exchange and innovation

8.2.4 System Implementation Review

Table 5 Allan Cole Roberts (2007), System Implementation Summary

<table>
<thead>
<tr>
<th>Stages of Development</th>
<th>Identify System Leader</th>
<th>Development of Consensus</th>
<th>Overcoming Cultural Roadblock</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Routinize open and functional cooperation</td>
<td>Guide relevant information in order to facilitate efficient knowledge use</td>
<td>Act as an agent of trust in order to motivation deeper collaboration</td>
</tr>
<tr>
<td></td>
<td>Alleviate the need for recognition and accolades amongst the actors due to shared benefits</td>
<td>A consensus secures a foundation of resiliency to the system by limiting detrimental concatenating issues</td>
<td>Approach the process from a common platform of understanding, reason and balanced roots</td>
</tr>
<tr>
<td></td>
<td>Diversifying the thought process away from resource-dependency towards a culture of knowledge exchange and innovation</td>
<td>De-contextualizing knowledge and by opening the channels of communication</td>
<td>First generating an agreement for collaboration, and then routinizing the process of cooperation</td>
</tr>
</tbody>
</table>

8.3 Securing the Sustainability of the System

8.3.1 Government Responsibility

The top priority of government is to initiate policy to stimulate innovation both within the framework of the helix, and at the individual level within the region. Once this is accomplished, understanding that rewards counter the risks of innovation, and policy will reflect a shift in the culture of governance within the milieu. Next, government must minimize the need for recognition in terms of innovation within the region due to the fact that geographical proximity does not immediately assume government responsibility. The stimulation of cooperation will need to be encourage through knowledge diversification and the shift away from resource reliance, and in this sense, the government’s role is to use innovation as both a tool for policy and a motivation for collaboration.

Based on this information, the government’s core focuses to secure a sustainable system shall be as follows:

- Develop both regulations and policies working towards innovation
- Incorporate the risks of innovation into culture, and accept this as entrepreneurial behavior
- Move away from the need for accolades as a result of geographical governance
- Initiate the psychological shift towards knowledge diversification
8.3.2 Industry Responsibility

Industries first responsibility is to continue to work with and enhance external networks while developing trust and cooperation with the actors of the helix. By stimulating their networks, idea generation will maintain its inertia and developments of new technologies will continue to benefit their business processes. Incorporating the research capabilities of the university and removing the onus put on the government to stimulate cooperation will ensure the sustainability of the system, and this begins with industry reevaluating their perspective of the other two actors. Through a development of trust and understanding, industry can fill their void in knowledge and know-how with the skills and competencies of the other actors.

In order for the system to remain sustainable, the industry must be motivated to engage in the following activities:

- Enhance external networks
- Developing trust and cooperation
- Continue to provide regional benefits from use of new technologies
- Routinize the universities' research capabilities into their strategy,
- Stimulate cooperation and resolve knowledge deficiency through the competencies of the other actors

8.3.3 University Responsibility

Through opened communication channels, the university should embed their pillars of sustainability and strategy of establishing a culture of knowledge and innovation to the other actors. Their framework of routinizing innovation at the individual level is one that can be mirrored in the helix, and the starting point for this routinization is reestablishing their current relationships with the other actors. With government, working on eliminating bureaucratic deterrents in research involves cooperating on policy issues, and routinizing the process of cooperation in research with industry are the two key elements in the change effort. Once these issues are addressed, university must enhance their audience of final users of their work to more than simply the academic community. This will motivate cooperation and allow academia to increase the research breadth of the issues they deem applicable.

The university is a main cornerstone to the success of an innovation system; therefore they must focus on the following issues in order to contribute to a sustainable system:

- Pillars of sustainability must be at the foundation of the helix for all the actors
- Communicate their framework of routinizing a culture of innovation
- Enhance their audience of final users
- Reestablishing their current relationships with industry and government

8.3.4 Mediators Responsibility

Once a system leader is established, constantly enhancing and cross-filtrating the competencies of the actors will sustain the innovation process. By using their skills as assets rather then hindrances, the mediator will establish a system where the motivation to collaborate will be guided by trust rather than suspicion. Establishing and sustaining trust will also thaw communication channels and create a flow of knowledge within the system that will reward the economy with innovation spawned from the actor’s collaborative action.

The focus for the mediator shall be as follows:

- Enhancing and cross-filtrating the competencies
- Allow trust to guide collaboration
- Create a flow of knowledge within the system
- Use skills as assets rather than hindrances

8.3.5 System Sustainability Review

Table 6 Allan Cole Roberts (2007), System Sustainability Summary

<table>
<thead>
<tr>
<th>Actor</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government</td>
<td>Regulations and policies for towards innovation</td>
</tr>
<tr>
<td></td>
<td>Initiate the knowledge diversification</td>
</tr>
<tr>
<td></td>
<td>Move away from the need for accolades</td>
</tr>
<tr>
<td></td>
<td>Incorporate entrepreneurial behavior</td>
</tr>
<tr>
<td>Industry</td>
<td>Enhance external networks</td>
</tr>
<tr>
<td></td>
<td>Counter knowledge and research deficiencies</td>
</tr>
<tr>
<td></td>
<td>Use of new technologies will provide regional benefits</td>
</tr>
<tr>
<td></td>
<td>Routinize the universities’ research capabilities</td>
</tr>
<tr>
<td>University</td>
<td>Routinizing their model for a culture of innovation</td>
</tr>
<tr>
<td></td>
<td>Pillars of sustainability must be at the foundation of the helix</td>
</tr>
<tr>
<td></td>
<td>Enhance their audience of final users</td>
</tr>
<tr>
<td></td>
<td>Reestablishing their current relationships with industry and government</td>
</tr>
<tr>
<td>Mediator</td>
<td>Create a flow of knowledge within the system</td>
</tr>
<tr>
<td></td>
<td>Enhancing and cross-filtrating the competencies</td>
</tr>
<tr>
<td></td>
<td>Allow trust to guide collaboration</td>
</tr>
<tr>
<td></td>
<td>Use skills as assets rather than hindrances</td>
</tr>
</tbody>
</table>
9 CONTRIBUTION TO THEORY

This chapter will be a brief summary of this study’s championing contribution to academic knowledge, or theory. The summary will leave the reader with an undisputed theme that has been developed throughout the paper to this point.

9.1 Mediator as an Actor

When compiling the works of various scholars in the discussion of innovation and sustainability, there was minimal elaboration on the imperative nature of a mediator in the configuration of the helix. Sheirer (2005) made mention of establishing a leader in regional development towards sustainability and Karapetrovic et al. (2007) also incorporated a leader in the process. However, the deficiency in these points, as well as with the theoretical framework that constructs the helix, is the contributions of mediator for the system. Mediator differs slightly from the term ‘leader’, in the guidance for the system can be built from the three actors and work within an equal partnership. What differs when a mediator is incorporated is the role it would play in maintaining inertia amongst the actors and developing a system of trust (8.3.4).

![Figure 7 Allan Cole Roberts (2007), Mediator Incorporated Into The Helix](image)

The theoretical contribution, therefore, is the confirmation that a mediator indeed must exist in the development of an innovation system. In practical terms, applying a system of innovation needs this role to harness and control the actors, as discussed in chapter eight. More importantly though is the theoretical derivatives that a mediator deplores. As identified in the empirical information collection and in the conclusion, a mediator has a role to play that overlaps into the relationships between the other actors, which is unique in theory and in practice. This contribution to theory is unique in the underdevelopment of its importance, identification, and development, and this leaves room for further exploration in a more elaborate study on this new actor in the model of the Triple Helix.

9.2 Tangible Roles

The practical roles the original three actors have in theory have been discussed in depth by virtually all authors who have discussed the helix. Where the contribution comes from in this paper is the identification of the key roles played by the actors in order to maintain the sustainability of the system. As outlined in Figure 8, the contributions that the actors must make have been narrowed down to a very practical level, and these contributions are viewed in this
study as the key points. It is important to state that the potential exists for these points to be studied in more detail and certain scholars may deviate from these points. However, this study has built towards this conclusion based on theoretical development and the collection of information, and within the parameters of this study, this contribution is validated.

9.3 Measurable Stages in Development

The final contribution to theory is seen in Figure 7 and the key issue to address here is in the functional, measurable steps that have been developed. Theoretically, the process has different processes in the development of a helix model, and these discussions lack the tangible element that must exist in order to turn the model into a functional, usable tool. The contribution, therefore, is the identification of the key stages in development of an innovation system, and what specifics are entailed in these stages. The importance in having a measurable characteristic in these stages is for benchmarking and the opportunity to identify with progress in the creation of the system.
10 FURTHER RESEARCH

This chapter proposes what the main possibilities are for further studies based on the topics covered in this thesis. Should this paper be used as a springboard for continued research, then the suggestions in this chapter have been prioritized as being the most feasible and relevant for academic research. What is more important to address here is what will be researched further, as opposed to who will conduct the studies.

10.1 Case Study

As discussed in section 2.9, approaching this particular study averted using a situation-specific case study. For further research, applying the findings of this study in a specific location can open the doors for argument for or against the contribution of this paper. Allowing for the findings to be used in varying settings also confirms the transferability of the study, which is a key element in validating the thesis on a whole (11.2.2). The intention of this paper was not to focus on a specific region and have the theoretical contributions be solely useful for that region exclusively. Rather, the point was to develop observations that could generalize the course of action that can be generally accepted, and interpret those findings versus that of theoretical laurels. Where a case study would prove beneficial is developing contextual-specific conclusions, and perhaps an elaboration of cultural variances can be developed.

10.2 The Mediator's Role

The theoretical conclusion of this study put a great deal of emphasis on the essential inclusion of a mediator, but due to the theoretical newness of this proposition, there lies room for further examination. Whether it develops through a practical case study, as suggested in 10.1, or further divulged through scholarly works in reflective areas, the mediator is a role in the configuration of the helix that must exist. The motivation behind such a suggestion is due mostly in part to the derived conclusion and the recommendation that continually cultivated in the information collection.

10.3 The Actors Push and Pull Factors

This study made some broad suggestions in regards to the relationships of the actors and what roles they play overall within the helix model. Further research could elaborate on actor specific roles and what the premier push and pull factors they embark on. This study inconclusively made interpretive conclusions based on the information contrived, but further research could develop a deeper, more thorough examination of the roles of the actors. From this recommendation, a heavily aggrandized study could work towards the most relevant shaping of a system of innovation.
11 Truth Criteria

The purpose of this chapter is to establish the stance used in the qualitative approach to this study. In doing so, the reader will better comprehend the degree of truth that this paper has, and validate the nature and aura of the findings.

11.1 Approach to Truth Validation

The dual dimensions offered by Lincoln and Guba (1985) in regards to research validation will guide the criterion used for this study. The dimensions include ‘trustworthiness’ and ‘authenticity’, and a short discussion of the characteristics entailed in these dimensions will commence versus the actions carried throughout this study.

11.2 Trustworthiness

According to Lincoln and Guba (1985), the degree of trustworthiness derived from qualitative research can be evaluated by using the following four elements. In the evaluation process of research, the element of trustworthiness is heavily embedded in the social dimensions involved in research conduct, therefore has an element of cultural in the validation criterion.

11.2.1 Credibility

Important in the deriving of a theoretical conclusion for the thesis is delivering the works to the appropriate audience. The degree of credibility will therefore be evaluated in accordance with carrying out “good practice and submitting the research findings to the members of the social world” (Bryman & Bell 2002, 289). Once the appropriate members of the social world, in this case the academic world and the practical actors in the thesis, confirm the writings in the paper, then the credibility of the paper has been validated.

11.2.2 Transferability

Contextual uniqueness in qualitative research leaves room for proximity-specific conclusions. Important in this research was to allow for the theoretical findings to be usable in different milieus, as opposed to being restricted to the location of the empirical findings. Under this distinction, readers can “make judgments about the possible transferability of the findings to other milieus” (Lincoln & Guba 1985), and the trustworthiness of the paper can be validated.

11.2.3 Dependability

Lincoln and Guba coin the phrase “auditing” in the process of establishing dependable research works. This process includes completely confirming all steps are taken in the research process, from start to finish, and ensuring for the reader that all the information gathered, formulated and derived has traceability, and therefore, dependability in the academic community.

11.2.4 Confirmability

The objective in creating confirmable works is making it “apparent that personal values or theoretical inclinations (do not) manifest” (Bryman & Bell 2002, 289) throughout the research process. Separating the personal investment in the practical problem was accomplished by allowing the theories covered guide the research, which established confirmability and adhered to the process of deductive research.
11.3 Authenticity
Where trustworthiness adheres to social dimensions in the formulation of research, authenticity speaks to the impact of the research, and those affected or use the research in their own (Lincoln & Guba 1985).

11.3.1 Fairness
Addressing the various viewpoints and perspectives that exist in the research process allows for objective, fair research to foster. Because of the nature in this hermeneutic study, incorporating the viewpoints of the various actors was, at the core, the base for the entire research approach.

11.3.2 Ontological Authenticity
One primary objective for this research was to have use outside of the academic community, and for practical usage for this research. The actors chosen in the study were obviously in a specific region, but allowing for the findings to be transferred to different milieus was vital due to the fact that ontologically, the social elements allow for this milieu to better understand itself (Lincoln & Guba 1985), but will allow others to do the same.

11.3.3 Educative Authenticity
Bell and Bryman (2002) use educative authenticity to allow actors to “better appreciate the perspectives of other members in their social setting” (289), and in the process of this paper, surely the actors will have the option to do this. Interpreting the viewpoints of the actors, in terms of themselves and the other actors, guided the paper from start to finish, therefore those perspectives confirm the authenticity of the research.

11.3.4 Catalytic Authenticity
The purpose of this paper was to study the process of recovery as a result of environmental change, and deriving from the research is the opportunity for the actors to allow this paper to guide them in the process of change. The conclusion has theoretical and practical applications, and should the “members engage in action to change their circumstances” (Bryman & Bell 2002, 289) as result of this paper, then catalytic authenticity has been achieved.

11.3.5 Tactical Authenticity
Tactical authenticity asks “has the research empowered members to take the steps necessary for engaging in action” (Bryman & Bell 2002, 289), and if the actors in the studied milieu choose to use the steps offered in the implementation of a innovation system, then tactically, the study has validity. From the perspective of the academic community, the future research into the mediator’s role in the helix would allow further engagement into the findings of this paper.

11.4 Concluding Critiques
This chapter has addressed many issues that validate an academic study, and by addressing and attempting to confirm these issues, readers should be able to identify with the genuine and useful nature of the study. In addition, forming a deeper opinion in terms of the underlying beliefs of the study will ensure for an unbiased interpretation of the findings.
RESOURCES


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29.01.07


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Fraser, L., Kamloops, BC, Canada, personal interview, March 15th, 2007

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McQuarrie, B., Kamloops, BC, Canada, personal interview, March 20th, 2007
APPENDICES

Interview Guide

Phase One – Identifying Broad Definitions

Economy
- What are the most vulnerable areas in the economical stability of the southern interior?
- Change is obviously present. What are some examples of strategy within your research department that shapes resiliency for the economy and what forms of adaptation are present?

Innovation
- How would you define innovation?
- What are the main characteristics of innovation?
- How is innovation visible in the regional economy?
- How are existing resources in the region built upon towards innovation?

Sustainability
- How would you define sustainability?
- What in your view are sustainable innovation systems?
- What are the elements needed in order to create sustainable economic conditions?
- Do you have sustainable systems in place that deliver beneficial services to the economy of the region?
- Are there identifiable forms of economic sustainability in the region?
- Does the region have the capacity for sustaining innovation?
- What guidelines are in place to encourage sustainable innovation?
- Who takes the lead role in innovation regionally?
- Has innovation been integrated into the region in a sustainable manner?

Phase Two – Relating the Definitions to The Helix

Triple Helix
- Explain what the triple helix is exactly, define the actors, and explain that this is an example of an innovation system
- Then explain that there are two main features within the model: Knowledge flows and the endless transition

Knowledge Flows
- To what degree does knowledge flow between government, industry and university in the region?
- Are you able to describe what type of knowledge it is?
- Is there a high rate of exchange between you and the other actors and what immediate barriers can you identify?
- Interdisciplinary knowledge flows are necessary for the helix to work. What strategies do you have in place to increase this flow between the actors?
- Are the agendas between the actors simply too different to bring together?
- Do you single out any specific degrees of resistance?
- Can you identify with the overall benefits that a helix can generate even though the actors may have independent agendas? Can this be mediated by strategy?
Endless Transition
- The role of science is effecting development in three ways:
  - Research – what shapes does research take in the region?
  - Knowledge – where is the cross-fertilization of knowledge witnessed in the region?
  - Innovation – do the actors work towards a constant presence of innovation?

(See alterations for actor-specific questions)

University Alternation

Phase Three – Interactions Between University and the Actors

Push and Pull Factors
- To what extent do local environmental problems create the need for your research activity?
- Where do you see the output of your research activity contributing to economic activity?
- What role do you see science and academia contribute to regional development?
- What is the role of academia in enhancing sustainable economies? Future industries?
- Deficiencies of knowledge in environmental areas often stimulate research from university. Is this stimulated internally or from external actors?
- What inputs (requests) do you receive from industry and how frequently?
- What inputs (requests) do you receive from government and how frequently?

Phase Four – Final Comments

Any questions or additional information

Industry Alteration

Phase Three – Interactions Between Industry and the Actors

Push and Pull Factors
- Where do innovations come from that are used locally? Global advances, regionally?
- Science is said to drive industry in all sectors, which means the interaction and need for universities. What do you say to that theory?
- Cooperation must occur outside of industry itself (meaning other mills, for example). To what degree is their cooperation with parties outside of the timber industry by representatives?
- Infrastructure for developing innovations discovered from science is not always present within the industry actors, so how are these new technologies accessed?
- Industry is the primary user of new technological advancements, but who initiates the research into this new innovation?

Phase Four – Final Comments

Any questions or additional information
**Government Alteration**

*Phase Three – Interactions Between Government and the Actors*

Push and Pull Factors
- What is your policy involving innovation and does this policy incorporate academics and businesspeople?
- A collaborative effort towards innovation is said to be pushed outwardly from government policy: do you agree?
- Are their regulations and financial schemes in place to motivate university and industry to be innovative in this region?
- Does this regional government encourage innovative behavior through public funding, and if so does create sustainability in the economy?
- Linkages between the three actors is said to work towards a knowledge-based economy. Can that viewpoint be sustainable through policy and divert the region from being a resource based economy?

*Phase Four – Final Comments*

Any questions or additional information