USING COMPLEX ADAPTIVE SYSTEMS THEORY TO DRIVE SYSTEM HEALTH MEASURES FOR A PROVINCE-WIDE HIGHER EDUCATION SYSTEM

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Dedication Page

To my wonderful parents, my siblings, and my better half: Without your love, support and encouragement I could not have completed this research effort.

Abstract

Beginning in October, 2013, an Advisory Group was convened by the Province of Alberta, Canada to 'tame' the operationalization of a Results-Based Budgeting (RBB) exercise to be imposed upon Campus Alberta. Campus Alberta is the governmental institution that encompasses and oversees all 26 post-secondary institutions of Alberta. Utilizing Burgelman's Model (1983), I study Campus Alberta. The purpose is to identify and incorporate in the larger set of RBB measures such indicators that monitor those conditions that cause Campus Alberta to be in the complexity region. Furthermore, to ensure that co-evolutionary dynamics do not shift Campus Alberta from the complexity region, I employ McKelvey's (2002) work on managing co-evolutionary dynamics in complex adaptive systems through damping mechanisms. Therefore, an applied suggestion my research offers is '2M': Monitoring the overall health of the system and, then, Managing co-evolutionary dynamics so that the system can be attuned to changing dynamics of the eco-system.

Acknowledgement

I wish to express my gratitude to my supervisor, Dr. John Usher, who first introduced me to complexity science, acted as a compass during this research journey, keeps guiding me as a mentor does, and has inspired me to become a better researcher; Dr. McKelvey, one of the leading authorities on complexity science, for participating as the External Examiner and appreciating my research work; Dr. Lindsay and Dr. Sutherland, for taking the time and effort to participate as readers and providing valuable suggestions on the research work; and finally, to all my colleagues, the M.Sc. Cohort 2013, and the faculty members for their suggestions, assistance, and willingness to tolerate my non-stop conversation in the class.

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1 Introduction

There is a general acknowledgment amongst many practitioners and organizational scholars that today's organizations are navigating in an intense, unpredictable – and often unregulated – competitive landscape. To survive, organizations need to gain competitive advantage; thus, organizations will then be able to accomplish their objectives by continuously evolving to various dynamical tensions that result from rhythmic and non-rhythmic changes in the fitness landscape (Burnes, 2005; McMillan, 2004).

It is important to recognize that the taxonomy of a system is shaped continuously by non-linear interactions amongst its agents. Using a positivist framework limits a researcher to understand system's dynamics and health because such an approach defines a system as having rational processes and predictable behavioral modes. Since a human-integrated system displays non-linear interactions, there has to be a recognition amongst researchers and practitioners that resulting outcomes of the system may not necessary reflect anticipated objectives (Mitleton-Kelly, 2003). In effect, we have to realize that large organizational systems behave as complex systems and display processes that function as "mutual-causal, deviation-amplifying, [and] positive feedback" (McKelvey, 2002, p. 1).

Embedded in a complex system are co-evolutionary dynamics that ignite new-order creation in the system; thus, allowing for the system to function, sustain, and continuously adapt to evolving drivers of the ecosystem. (McKelvey, 2002). Organizational scholars suggest that complexity science can play an important role in enhancing our understanding of the health and mechanics of complex systems (Brown and Eisenhardt, 1997; Lichtenstein et al., 2006; Allen et al., 2011).

Since today's organizational system is emblematic of an open system, complexity scholars, working in the field of organizational studies, emphasis that such a system presents characteristics of a complex adaptive system, in which the constituents are interdependent and directly/indirectly interact with each other. It is then a misnomer to fixate, ontologically, an open system with predictable cause and effect (Anderson, 1999; Kauffman, 1993; Holland, 1995).

Envisioning a system as being a complex adaptive system allows a researcher to shift focus from a primordial reading of a system: multiple independent variables explaining variation in few of the dependent variables at the same level; towards a holistic analysis that provides deeper interpretation: variables at all levels of analysis are interdependent and various orders of emergence can occur depending on how the variables are interconnected to each other. Such a model can then represent new aggregated summations that result from non-linear interactions amongst variables of the system.

An educational system also exhibits elements of a complex adaptive system; in that, it is dynamical and emergent, occasionally unpredictable, non-linear interactions materializing between various components and operates in a continuous changing ecosystem. Consequently, such a learning system adapts to changing drivers of its ecosystem through the emergence of self-organizing behaviors (Morrison, 2006).

It is important to realize that a complex adaptive system operates most efficiently within a range that is defined by two critical values. Too little and there is complacency, but too much then there is chaos. The objective, then, is to steer a complex adaptive system past the first critical value, prior to which it operates as a bureaucratic system, through empowering the system with self-organizational behavior that will generate adaptation and

innovational capabilities. It is also essential to inhibit the adaptive tension from reaching the threshold level of the second critical phase which can result in the system becoming chaotic (McKelvey, 2002). I review this work on critical values in more detail in chapter two.

The primary stakeholders of Campus Alberta agree that the system of post-secondary institutions in Alberta is comprised of many interdependent/interrelated sub-systems. It is important to also recognize that Campus Alberta is a complex system. Such an approach will then pave the way to understand how changing drivers in a global competitive landscape affects Campus Alberta (Advisory Team, 2014).

For Campus Alberta to function effectively, it is necessary that it remain healthy, vibrant, resilient and adapt to changing dynamics of the eco-system. By answering, sequentially, the following set of research questions, I hope to provide theoretical insights and practical implications on how a system like Campus Alberta can function in a state that allows for generating new-order creation, adaptability and innovative capabilities in the system:

1) *What are the necessary conditions that a self-organizing system exhibits?*
2) *How can these necessary conditions be monitored to ensure that the system remains in the region of complexity?*
3) *How can the system be managed to remain as a self-organizing system?*

As such, this research has been undertaken to understand the conditions needed to allow for co-evolutionary dynamics to transpire in Campus Alberta so that new-order creation can respond or adapt to changing drivers of the competitive landscape. In this way, I will then be in a position to propose indicators to monitor the overall health of the system

and present adjustable tools to manage co-evolutionary dynamics so that Campus Alberta remains as a self-organizing system.

In chapter two of the thesis, the literature review begins by broadly describing the factors that have shaped the contemporary approach to managing the educational system. It presents social, political and economic reasons for the fixation of the idea for the state to regulate the educational system. By juxtaposing two approaches for handling educational system, this chapter first introduces those factors that have become the rallying cry for the New Public Management (NPM) to be employed for governing and managing the higher education system.

Following the discussion of RBB in the context of NPM, I review the intra-organizational evolutionary framework of strategy development put forward by Robert Burgelman (1983, 2002). This model provides a means of integrating conventional 'business as usual' performance monitoring with the ability to assess the supporting conditions and +/- contributions of new-order creation through autonomous strategic behaviors.

Next, the basic outline of complexity science is presented; conditions, features and interactional dynamics in a complex adaptive system are discussed. Then the next phase in the literature review shifts focus towards reviewing current work on the application of complexity science in the realm of organizational studies.

The third chapter, on research methodology, sets the guidelines/standards for studying Campus Alberta. An analytical approach will be taken for studying this system through meanings and processes that emphasize the system's contextual setting: accomplished by using the method of the case study. Justification and reasoning for the

type of case study are also discussed, along with describing the generic characteristics of the case study. In addition, there will be discussions on the issue of validity and reliability, form of theory used, evidentiary process, and analytical framework. An argument is made for the Burgelman model of "Evolutionary framework of the strategy-making process" (Burgelman, 2002, p. 9) to be applied as the analytical framework to study Campus Alberta.

From the application of the principles and framework discussed in Chapter 3, I will gain extensive descriptive details of Campus Alberta that will be presented in Chapter 4. This will be made possible by developing a thick description of the research site.

The fourth chapter will provide me the data on Campus Alberta to analyze and interpret. Consequently, in the fifth chapter, I will be in a position to discuss those conditions that need to be monitored so that the system remains in the complexity region and thus be able to generate co-evolutionary dynamics. In addition, adjustment tools that manage the rate of co-evolutionary dynamics so that the system remains in the region of complexity will be presented. In the end, I will conclude by presenting the theoretical contributions and practical insights that my work makes for studying, monitoring and then managing the health of this and similar systems.

2 Literature Review

2.1 Managing Educational System: Mapping Strands

Unpredictable forces and unanticipated events are driving economies of today's nations. While we may not be able to predict accurately as for what lies ahead for a country's economy in the far-off distant, what is possible is to maintain and sustain the continuous growth of a nation's economy. A constant stream of research is validating the notion that for a country to prosper economically, it is imperative to set in place advanced learning systems that generate research and novel interpretations so that a nation can adapt to global drivers (Veerman et al., 2010; Krueger & Lindahl, 1999, 2000; Blundell, Dearden, Meghir, & Sianesi, 1999).

Many theoretical and empirical studies (e.g. Nelson & Phelps, 1966; Hanushek & Wößmann, 2007; Chen & Feng, 2000; Becker, 2009; Cohen, 1982; Fuhrman & Elmore, 1990; Cohen & Spillane, 1992; Dahlin, 2002) suggest that there is a positive correlational relationship between the policies formulated, and implemented, for governing educational systems – at the institutionalized and societal level – and the economic growth of a nation.

Along with pragmatic motives, competing socio-political ideologies of political groups have driven the subject of managing higher education system (Ball, 2012; Taylor, 1997). It is important to recognize that any strategic planning that is formulated for managing higher education system should not be ill-advised or myopic in nature; mental models for regulating organized systems should not be based on preconceived dogmas. If done, then adverse effects may manifest in the form of the state having diminishing capability to compete in the regional and international political arena and market systems.

There seems to be converging of consensus amongst organizational scholars and practitioners that a traditional form of hierarchical structure does not possess the capability to activate/set off a complex organizational system – in a volatile/fluctuating eco-system – into becoming an ambidextrous organization (Adler, Goldoftas, & Levine, 1999; Barker & Mone, 1998; Schollhammer, 1982 Pierce & Delbecq, 1977; Duncan, 1976). The traditional form of structuring restricts generating new-order creation that arises from polygonal patterns and processes of activities amongst varying agents that are embedded in today's organization. Neither does this form of tall structure recognizes that today's system displays vast array of connecting nodes between diverse agents from which multifarious 'unintended' outcomes can unexpectedly affect the system's efficiency and effectiveness (Gleick, 1987; Jacobson & Wilensky, 2006). In addition, arrangement of traditional hierarchical structure produces natural tension/friction that arises from top-down controlling mechanisms: aiming for static efficiency (Burns & Stalker, 1961; Klein, 1984); and unanticipated conditions/situations arising in the fitness landscape and ecosystem of the system, that requires the system to generate dynamic capabilities and search for new knowledge (Ghemawat & Ricart Costa, 1993).

Across the globe, present-day governments are starting to acknowledge the important role/function that education and innovation play in economic progress. Subsequently, states have become more vocal and preoccupied in trying to manage the performance of higher education system. (Marshall, 1995; Barnetson, 1999). With increasing budgetary constraints caused by continuous recurrences of global recession (Eicher, 1998), the governing bodies of nations are paying closer attention to trying to manage higher education system by handling the following basic configurations of

governance: state regulation, relates to the directives set by the government; stakeholder guidance, relates to stakeholders who are delegated power by the government to guide remaining agents within the system; academic self-governance, relates to the tasks and functions of the professional unit of the system; managerial self-governance, relates to the role of the hierarchical structure of the system; and competition, relates to the utilization of scarce and limited resources (De Boer, Enders, & Schimank, 2007).

Through the managing of the higher education system, the assumption is that the performance of the system can also be monitored; thus, correlational association with a nation's economic progress can be ascertained from knowing about the following state of conditions of an advanced learning system: "enrolment in higher education, higher education and its professionals, quality, contribution to the knowledge society, international context, and structure of the system" (Veerman et al., 2010, p. 5).

There are two principal approaches toward managing a higher education system (Salter & Tapper, 2000; Fumasoli, Gornitzka, & Maassen, 2014). The first approach rests on the concept that the autonomy of higher education system is to be mandated by state-based policy (Robbins, 1963; Ferlie, Musselin, & Andresani, 2008). Following this approach will enable greater space of academic freedom through which qualified academics will become major stakeholders in governing the system, and monitoring system's health; thus, leading to wide-ranging positive impacts on the development of the society (Yudof, 1986; Aghion, Dewatripont, & Stein, 2008). Such an example was seen in United Kingdom's advanced learning system through the end of seventies.

The second approach questions the accountability provided by traditional overseeing of the advanced education system; there is rising suspicion on the part of policy-

makers and the public on the general performance of autonomous public systems. Both segments of the society are questioning excessive endogeneity of higher education system and "no longer prepared to accept that higher education is self-justifying and wish to expose the activities of the secret garden. With greater expectations being placed on it, higher education is being obliged to examine itself or be examined by others" (Barnett, 1992, p. 216).

An additional reason is that the effects of the higher education system are more firmly anchored in the mind of the society than ever before. Moreover, with the generation of knowledge/research becoming a principal drive for economic growth, it is then the state's responsibility to ensure that the outcome of the system matches/adapts to current/future societal and economic demands (Slaughter & Leslie, 1997).

Finally, with connections becoming stronger amongst "the triple helix of university-industry-government relations" (Etzkowitz & Leydesdorff, 2000, p. 109), substantive force is being put on the state to act as regulatory body by different societal segments. As such, it is the responsibility of the state to govern the flow of innovation, creativity and new technological developments (e.g. genetically modified food) (Etzkowitz, 2003). Such a line of reasoning assumes that only the state has the necessary capabilities/abilities to ensure a synthetic and balanced mediational drive occurs between societal interests, economic demands and research orientation of higher education system.

The contemporary approach to governing an advanced education system places much emphasis on the role of market forces as having an extensive function in shaping the governance of the higher education system (Dill, 1997). Based on this perspective, teaching and research are considered as commodities that are to be optimally utilized for gaining

profit maximization. Consequently, the market landscape for buying and selling such commodities is then to be governed, regulated, controlled and evaluated by the state using private sector managerial logics (Neave, 1986; Van Vught, 1995; Amaral, Meek, & Larsen, 2003). As a result, the government is to be encouraged by other stakeholders to become a major player in the educational market segment.

Such an ideological approach considers that the intervention of the state can ensure increased stimulation of market forces for profit maximization or, if required, result in detecting and repairing flaws and failures of the market structure. From this approach came the idea to expand the concept of 'New Public Management' (NPM) into the domain of higher education system. Therefore, the governing of higher education system is then to be associated with an overarching strategy/regulation promulgated by the government; enacting of decision in the operational procedure of the system is to be applied through the principles of NPM (Ewalt, 2001).

Much of the literature on NPM posit the emergence of this particular strand of managerialism between 1970s and 1980s (McTavish, 2003; Christensen & Lægreid, 2011; Fusarelli & Johnson, 2004): Christopher Hood was the first, in 1991, to coin the term "New Public Management" (Hood, 1991, p. 3). Having a broad concept that is linked with "marketization, privatisation, managerialism, performance measurement and accountability" (Tolofari, 2005, p. 75), it has been embraced as the predominant ideology to managing public system in many parts of the globe (Osborne & McLaughlin, 2002; Nikos, 2000). The aim of NPM has been to stand as a reformative process that improves efficaciousness, enhances response time and reduces the expenditure of public system (Christensen & Lægreid, 2011).

Reformed policies that are theorized in the academic setting and strategized in the policy arena often tend to be supportive of the suggestions of applying NPM's concepts in public systems (Deem, Hillyard, & Reed, 2007). With the state's political will for top-down application and continuous support shown by influential interest groups (Ferlie, Ashburner, Fitzgerald, & Pettigrew, 1996), the aim has been to present this concept as a modifier that modulates the processes of public systems and drives structural changes in the system for greater efficiency (Deem et al., 2007; Bovaird & Löffler, 2001). In other words, the determinants for utilizing NPM as a reformative practice are political, social and economic factors (Aucoin, Christensen, & Laegreid, 2011).

For instance, with the emerging popularity of right-wing political parties and then ascending to the position of governance, e.g. government of Ronald Reagan in USA and government of Margaret Thatcher in UK in the 1970s, there was visible increase of support amongst the members of policy-makers to consider public systems as being in markets that are to be regulated by market mechanisms (Larbi, 1999) and managed by the political will of the state (Ferlie et al., 1996).

Second, fiscal problems, economic stagnation, public debts, and continuous rise in unemployment rate caused nations to look for ways to maintain efficiency in the public systems (Larbi, 1999; Boston, Martin, Pallot, & Walsh, 1996).

Third, scholarly efforts by organizational scholars in the 1980s and 1990s highlighted the contrast between the dismal performance of public systems and the effectual mode of managing, and the resulting positive accomplishments, in the private sector (Aucoin et al., 2011).

Other reasons for a shift towards NPM were a greater demand by the society for accountability of public systems; more players in the media sector started to compete for acquiring latest information on the health of public systems; and, organized interest groups began monitoring the performance of the public system (Aucoin & Heintzman, 2000).

The principal characteristics that NPM displays when used in managing public sector are: marketization, relates to running public systems with managerial style of private sector; performance accountability, relates to evaluating outputs and measures through quantifiable methodology; unitary leadership, relates to greater discretionary power being exercised by top management; devolution, relates to separation of policy formulated by senior executives with the implementation of the policy being done through a group of managers; fixed-term labour contract instead of long-term contract; discipline, relates to emphasis on improving efficiency through allocation of resources toward such agencies that meet the targeted objectives; and competition, relates to focusing on creation of multiple sources of supply rather than a singular supplier in the public system (Larbi, 1999; Boston et al., 1996; Yamamoto, 2003; Boston, 2011).

The emergence of NPM's phenomena made the stakeholders – particularly the shareholders – fixated on the performativity of the system. Having a more expansive meaning in comparison to the word 'performance', the term 'performativity' is associated with the idea of maximizing inputs for producing most efficient outputs (Lyotard, 1984). In the background setting of increasing budgetary constraints and declining trust amongst many sectors of the society on the performance of educational system, the conceptual framework of performativity resulted in advanced learning system's outputs being

delineated by benefits that could be quantified through routine inspection of the system (Lyotard, 1984; Locke, 2013).

2.2 Fixation on Performativity: A Shift towards Result-Based Budgeting

Trying to attempt performativity within public sectors, states across the world started to undertake budgeting reforms as a mechanistic tool for improving managing of resource allocation and making practical decisions on budgeting policy. (Miller, Hildreth, & Rabin, 2001; Schick, 1990). The usage of this implementing procedure framework is labeled as result-based budgeting (RBB) and also termed, at times, performance-based budgeting (PBB).

Managing allocation of resources to enhance profit-maximization in a system through the approach of RBB rests on four principal factors: exposition of the primary rationale for allocation of the resources along with framing of assessable and quantifiable measures; documentation and reporting of previous performances accompanied by assembling broad displays for cost comparisons amongst programs; flexibility in allocating resources and endowing incentives as long as the requirements of the system are being corresponded; and routine evaluation of the various agents in the system to ensure optimization of output (Carter, 1994).

In addition, the appropriate contextual requirements needed for implementing RBB are: existence of tangible objectives and outcomes along with a procedural process of good practice in placed; designed metrics for measuring and calculating performance; validating framework for rewarding; and sustainable methodology for resource distribution (Kong, 2005).

In some places, PBB has had notable success, e.g. Tennessee (Anderson, Johnson, & Milligan, 1996). Much of emerging evidence for positive contribution to the RBB process tends to focus on the system being able to demonstrate increased level of efficiency due to effective decisional procedure, enhanced operational process, clearer channel of communication within strategic episodes, accountability on the decisions made by managers and better management through cycle of monitoring, and evaluating/reporting performance measurements (Smith, 1999).

When applying RBB framework in a system, it is important to acknowledge the following individual shortcomings in the process: uncertainty regarding the conditions that need to be considered as indicators for measuring the performance of the system; resource allocation based on performances of the agents (that fluctuate over a period of time) can make the system unstable (Ashworth, 1994); dispute in selecting criteria for measuring performances; choice of benchmarks (Burke and Serban, 1997); also, the issues of "pretense of unbiased objectivity … challenge of measurement … increased administrative burden and higher costs … [and] failure to bring about meaningful change" (Bower, 2013, p. 7).

The current framework of RBB that is presently utilized limits formation of co-evolutionary dynamics in a system; being a self-organizing system is a requirement for adapting to changing drivers of the ecosystem. Coupled with the above-mentioned problematic issues, using RBB in its current version may cause the health of the system to become unstable; thus, production of new-order creation will be crippled by the system. Such an approach blinds the recognition that human-integrated systems are, in nature, driven by non-linear interactions. This does not mean that RBB is an inoperable tool for

improving the efficiency of the system. On the contrary, it is part of the solution to ensure that the health of the system is in such a condition that the system is then able to generate autonomous strategic behaviors. However, for this process to be operated in a manner that allows the system to have a greater probability to acquire competitive advantage, RBB has to be embedded in complex adaptive systems thinking within an intra-organizational evolutionary framework. I will now begin discussing the conceptual model provided by Burgelman (1983, 2002), and then move to discuss, in detail, complexity science and how it has been applied to study organizational systems.

2.3 Burgelman's Model: Intra-organizational Evolutionary Framework of Strategy-Making Process

Burgelman's Model presents two distinct generic processes that transpire in a complex system: an induced loop shown in the lower half of the figure (on the next page) and an autonomous loop shown in the upper half of the figure. Strategy making is thus conceptualized in terms of induced and autonomous processes. The amount of variation in the system is dependent on the two processes; internal selection occurs through the two distinct context determinations; and internal selection corresponds to the concept of comprehensive strategy (Burgelman, 1983, 2002).

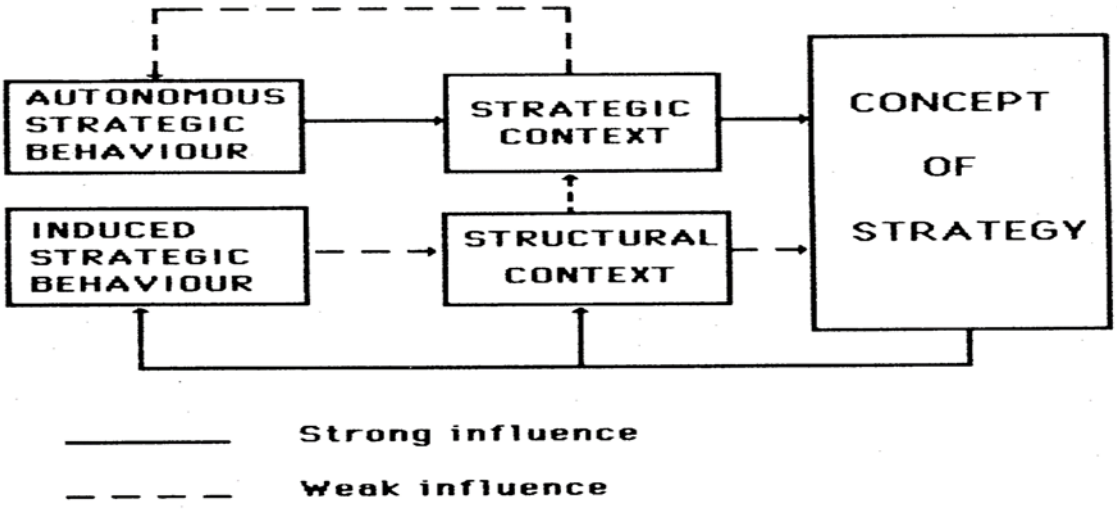

Figure 1. Burgelman's Model. Sources*:* Adapted from (1) R. A. Burgelman, 1983, A model of the interaction of strategic behavior, corporate context, and the concept of strategy (p. 65), *Academy of Management Review*, 8: 1*; (2) R. A. Burgelman, 2002, Strategy Is Destiny (*p. 9*), New York, USA: The Free Press.*

The traditional top-driven managing design manifests in the induced strategy process and results in minute variance in organizational behaviors; as such, induced strategic behavior follows the existing direction of the comprehensive strategy of the system. It is the corporate strategy that becomes the foundation for defining the past successes and anticipated objectives of the system: agents reaffirm the strategic intent and reflection of the possibility of gaining organizational learning by the comprehensive strategy.

Second, system activities tend to occur mainly in the induced strategic process. These activities closely align with the comprehensive strategy of the system: customary leadership is maintained, and standardized projects/collaborations are encouraged and nurtured.

Third, with a system becoming larger and more complex, the linkage between strategic actions of the system with the system's comprehensive strategy becomes weaker because multiple processes occur simultaneously at different levels of the system. The induced strategy process provides coherence – yet also strategic inertia – in the system by way of structural context determination. Generic concept incorporating varying modes of administration by the management for directing system's objectives are materialized in the structural context determination. Through this context, selection of induced strategic behavior is selected in order to become aligned with the current aspiration of the system.

A heightened promotion of the structural context makes the system's rules more formalized and structuralized; which in turn, leads to a strategic behavior becoming more conformist and having less potential for driving substantial changes in the comprehensive strategy of the system. Consequently, variation in the strategic proposals wane with more emphasis on having a homogenized standard for evaluation and promotion of strategic behavior. However it is also to be acknowledged that it is the structural determination context's "structure, planning and control systems, resource allocation rules, measurement and reward systems, among other administrative arrangements, as well as cultural aspects such as recruitment and socialization processes and more or less explicit principles of behaviour" (Burgelman, 2002, p. 12) that ensure stability in the intra-organizational environment.

In this way, alignment forms between the actions of the agents that generate induced strategic behavior with the corporate strategy of the system. Such a configuration allows for the overarching strategy to be realized, system's characteristics to remain unchanged, and system's genotypes to be replicated in the next phase of the organizational

life-cycle. Consequently, there is a greater tendency for strong strategic inertia to manifest with a strongly induced strategy process, along with promoting those mechanisms that provide a rational explanation for resisting changes in the system.

Autonomous strategic behaviors, on the other hand, form on the system's peripheral edges by groups of agents that have a differing approach than the conventional initiatives taken in the system. There is a greater chance that with the system having a bundle of resources, certain units of resources are utilized for creative actions/activities that emerge at the level of autonomous strategy process that then allow for redefining meaning of opportunities to gain competitive advantage. At this level, agents conceive of new opportunities, then engage in affecting system's influencers to put system's resources in place for new projects: agents demonstrate new opportunities as being aligned with the comprehensive strategy of the system. The resulting effect is a redefined system's landscape, with a change in the overall strategy of the system.

Usually, new-order creations are formed from those system's competencies that are in a present condition not acknowledged as being distinct or centrally important to the system. Most of these emerging initiatives die out due to lack of obtaining system's resources. However, if nurtured and then grown, the result is a reconfiguration of the existing system's fitness landscape. Such an association is mediated through strategic context determination; thus, allowing for bridging and forming of linkage between emerging initiatives and the system's strategy: modifying, adjusting and revising the prevailing system's strategy becomes possible. It is from this context that opportunity is provided "to evaluate the adaptive potential of autonomous strategic initiatives in an informed way." (Burgelman, 2002, p. 14) If an emerging order is viable, then such an

amendment in turn is integrated into the induced strategic process. Organizations may, therefore, be able to identify and incorporate frame-breaking ideas and behaviors into their strategies that might otherwise act as disruptive forces among existing players; being blind-sided is avoided.

Both, the induced and autonomous, processes occur simultaneously with the former reducing variation and the latter enhancing variation in the system. For a considerable period of organizational life-cycle, the induced strategy process has the stronger influence on the system. In addition, there needs to be a recognition then that the system demonstrates pairing of exploitation and exploration; hence, generating incremental and radical changes in the system.

What is required is that closer attention be given for observing new-order creations because such changes may initially appear as insignificant but can later radically transform and change the system. Such a change tends to be unexpected, uncontrollable, and unpredictable with initially the system having "no clear understanding of its strategic importance… and how it relates to the… distinctive competencies" (Burgelman, 2002, p. 16). Consequently, the important implication of the strategic context determination process as managing emerging actions in order for the health of the system to remain stable needs to be emphasized. As such, the two distinct context determinations become balancing means for ensuring that complex adaptive system remains in the region of complexity by managing induced strategic behaviors and autonomous strategic behaviors at any given phase of the system's life-cycle.

Burgelman's Model has been operated in a practical setting, that is in Intel Company. Accordingly, strategic literature has used Burgelman's Model to conduct

organizational research on formal theories of compelx adaptive systems, structural inertia, learning and adaptation. Consequently, research indicates that corporate longevity depends on the ongoing cycles of induced and autonomous processes. In this way the corporation is renewed, while also remaining viable to function effectively. Such an insight is parallel to the concept of complex adaptive systems theory; in that, a complex adaptive system evolves to the drivers of the eco-system when the mechanisms of mutations and innovations occur stochastically (Burgelman & Grove, 2007).

2.4 Complexity Science: Inception

If human-integrated systems are considered to have non-linear dynamics and were sudden changes and rapid fluctuations to occur, then our thinking of managing such a system needs revision. Such a system does not exhibit fixed sets of interactions between individual agents; the resulting outcome caused by interactions amongst the agents are differential values of outputs. Consequently, the conventional approach taken to studying systems through the lens of reductionism needs to be shifted towards observing the system from a holistic perspective.

Complexity science provides an informative approach to observing systems through a holistic paradigm. Organizational scholars are increasingly using complexity theories to enhance understanding of complex social systems. In essence, complexity science provides us with the tools by which we can analyse a system that has many interacting and network parts and in which complex cascades of plasticity emerge due to the "behavior of macroscopic collections of such units that are endowed with the potential to evolve in time" (Conveney & Highfield, 1995, p. 7).

Complexity science projects interactional dynamics amongst agents as being non-linear in nature. Ontologically, then, actuality of existential relation cannot be perceived from a positivistic framework but through the basis of realism in which behavior and activities between agents materialize in the form of co-evolutionary dynamics (Adam, 1995; Adam, 2013).

Originating from the research of the scholarly community in natural and physical sciences, the principles of complexity science have the potential to influence and change the way research is carried out in the life sciences and social sciences (Gell-Mann, 1995a). Organizational scholars argue that the application of complexity theory can be used as a technique for managing organizations more effectively in a continuous changing competitive landscape (McKelvey, 1997; Anderson, 1999; Brown & Eisenhardt, 1998).

Works undertaken by scientists studying complex systems have been profound and have given major epistemological and application breakthroughs in understanding complex systems. For instance, the concept of complexity science has been utilized to understand complex adaptive systems (Kauffman, 1993; 2002; Holland, 1995), cooperation (Axelrod, Axelrod, & Cohen, 2000) and increasing returns in economy (Arthur, 1994).

The current frame of reference in social sciences mistakenly considers changes in social systems to be explainable through laws of atomized behavior, in which the ontological reality of a system is equal to the summaries of arrangements and configurations of its agents' behaviors. As such, changes in social systems are explained through aggregated individualized outcomes and consequences (Heylighen & Campbell, 1995; Leydesdorff, 1993).

A second mistaken assumption in the field of social sciences tends to be the perspective that organizational systems are inclined toward a state of stable equilibrium that only has a single state of optimality. Dynamics that appear as detached from the steady state of equilibrium are identified as flawed processes that can only lead to failing consequences for the system (Young, 1991). Accordingly, this perspective reduces acknowledging the importance for a system to be in the complexity region; thus, be in a position to generate new-order creations.

Through the diffusion of the open-systems perspective amongst organizational scholars since the mid part of the twentieth century (Anderson, 1999), the idea of a conceptual framework for complex adaptive system as being emergent, self-order creation, with evolutionary phases of change and adaptation to the constraints of its ecosystem has become a prominent epistemological approach to studying organizations (Allen et al., 2011). Before beginning to develop a comprehensive understanding of a complex adaptive system, there is a need to distinguish between complicated and complex systems.

Complex systems provide us with complex questions to solve, whereas complicated systems offer complicated questions. Cilliers (1998) has expanded upon the demarcation points between complicated and complex systems. According to him, even though a system may have high numbers of constituent parts and does perform sophisticated amounts of activities, yet if such a system can be analyzed with precision and detail then such a system will be a complicated system. An example of a complicated system would be the manufacturing of a commercial aircraft. On the other hand, a system is complex when it exhibits constituents that have non-linear relationships amongst each; and, that can only be analyzed by accepting certain latitude of imprecision and uncertainty.

Glouberman and Zimmerman (2002) have presented contrasting factors between these two systems: complicated system can have an optimistic approach with a high degree of certainty in the outcome; whereas, a complex system will always result in uncertainty of the outcome: even if the approach to the problem seems, or appears, optimistic.

At a detailed level of analysis, a system can be complex due to dynamic interactions between the agents leading to increased variety – which is the number of possible states of situations (Beer, 1981). However, at the decisional level, the system might be seen as either complicated or relatively simple. For instance, a situation that requires immediate action may have arisen due to complex interactional forces between the system and its encompassing ecosystem and the choice of options that can be taken by policy-makers are limited in scope.

I will now describe the two broad scientific programs that have influenced the development of complexity science: the European paradigm of complexity and the North American paradigm of complexity (McKelvey, 2002).

The European paradigm of complexity is attentive towards the resulting self-organization of the system, in a far-from-equilibrium state of condition, through initial disorder that is triggered by a disturbance in the system. As a result, order surfaces through fluctuations and out of chaos (Nicolis & Prigogine, 1977; Progogine & Stengers, 1984). Autogenesis or synergetic system theory aims at describing and expounding how emergence of self-organization occurs through interaction amongst agents of various systems; e.g. for organism's evolutionary system see Kauffman (1993); for organizational system see Drazin and Sandelands (1992). The emerging property of self-organization is a natural process that occurs in a system that is dissipative in nature and operates in a

continuous state of emergent order through energized dynamics. Such dynamics are due to interactional forces being shaped by the induced tensions that arise out of the differential levels of energy between the autonomous entities of the system in relation to their environment (Prigogine, 1955; McKelvey, 2001). The given end shape of the order is structured through the continuous interaction amongst the varying agents leading to any expected, or unexpected, outcome for the organizational system. For instance, progress and synergy of learning amongst various localized agents in an organizational system that attempts to find intra-organizational responses to extra-organizational opportunities and threats can lead to new-order creation of the organizational architecture (Brown & Eisenhardt, 1997). In turn, agents will start adapting to the outcomes of the new-order creation. However, since dynamical changes take place in far-from-equilibrium conditions, a minute initiating effect can result in new dynamical interactions that lead to a new form of self-organizing system.

The North American school of complexity science pays attention towards life sciences and has placed more emphasis towards computational modeling. Through the usage of agent-based modeling, the influx of emergent forces in systems are studied by focussing on co-evolving agents in a contextual setting of hierarchical structure within a set frame of rules.

Complexity scientists are of the opinion that demarcating the boundary for a complex adaptive system is based on the analytic choice on the part of the researcher. As such, the purpose and intention of the observer define the description of the complex system. This is because complexity arises from a system that is open, and where continuous association amongst varying agents occurs in a contextual background of information and

energy that is being infused from the surrounding ecosystem. Therefore, to restrict or even define the actual boundary of such a system for analytical purposes is problematic (Cilliers, 1998).

However in spite of the issues in defining boundaries of complex systems, complexity scholars are of the opinion that there are certain essential elements that constitute a complex adaptive system. Numerous scholars have provided overlapping descriptions of the characteristics of a complex system. Such a system consists of large number of agents; interactions amongst the agents are dynamic; interactions amongst the agents occur in such a process that any agent can influence or be influenced by other agents in the system; interactions amongst the agents are sometimes non-linear, in that very small initiating events can cause large disruptive changes; interactions usually occur amongst neighbouring agents; interactions can result in positive and negative feedback loops; are open systems; do not operate in an equilibrium condition; have a history, that future is dependent on past activities; and an individual agent does not have the information concerning the behavioral pattern of the whole system: responds to information that is local and nearby (Nicolis & Prigogine, 1989; Jen, 1990; Mitleton-Kelly, 2003; Cilliers, 1998). Gaining an appreciation of these elements, can become a launching pad for applying them to managing the health of Campus Alberta.

2.5 Complex Systems: A Holistic Approach for Examining and Managing New-Order Creation

To provide a fuller explanation of how self-organizing leads to new emergent occurrence requires utilizing both conceptual frameworks of North American and European schools of complexity science. Consequently, for new-order creations to emerge

that provide the system the capability to adapt to ecosystem's drivers, require a complex adaptive system to remain in a space that is between two critical threshold levels. This area is known as the region of emergence/complexity (McKelvey, 2002). Below the edge of order (R_{c1}) the system turns into a deterministic system that is bureaucratic in nature (Brown & Eisenhardt, 1998); above the edge of chaos (R_{c2}), the system will enter the realm of chaos and become a chaotic system. (McKelvey, 2002).

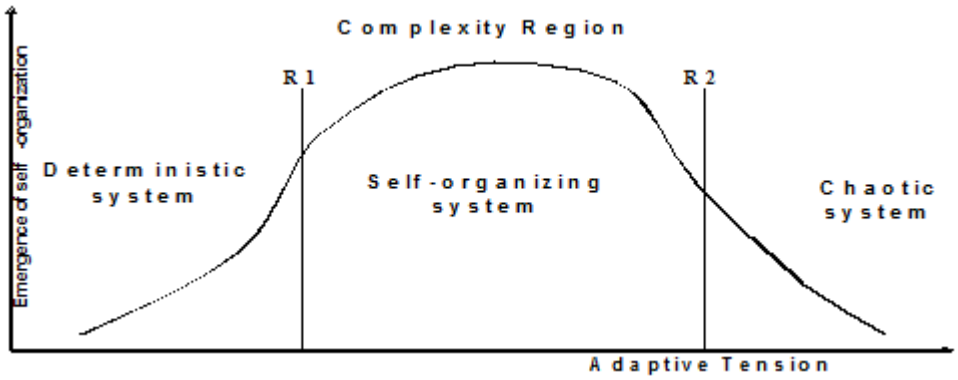

Figure 2. Emergence of Self-organization. Source*:* Taken from B. McKelvey, 2002, Managing coevolutionary dynamics.

It is necessary for the system to remain in the region of complexity because in this state will the system generate co-evolutionary dynamics that produce new-order creations; by means of emerging orders is a system able to adapt to the changing drivers of the eco-system. In addition, if co-evolutionary dynamics are not tamed then the system can become chaotic with dysfunctional processes; if emerging orders are not generated then the system becomes a deterministic system and will not be able to compete competitively in its eco-system.

It is possible for a system to transit through various regions and experience different degrees of complexity. Such a transition is characterized by movement of the system in

state space, i.e. possible values of the region. While it may be possible to anticipate the generic outline of activities of the system in the state space, it is almost impossible to predict the specific path that will be chosen. Therefore, the focus needs to be placed on understanding the characteristics of agents, dynamic interactions between the agents, and the paths taken by connected agents. By observing what forms of co-evolutionary dynamics are required to allow new-order creations to emerge, it may be possible to gain insight into how to encourage them or how to inhibit them.

2.6 Agents: Heterogeneity and Dynamical Interactions

The arrangement of heterogeneous interacting agents in a complex adaptive system are archetypally configured in a hierarchical structure in which new sub-levels of hierarchy can be established whenever and wherever atomized agents are massed (Simon, 1995). Moreover, an individual agent can appear to be amongst different multiple levels with each particular level of hierarchy consisting of a bundle of atomized agents that function autonomously and produce tailored responses to localized occurrences (Langton, 1995; Kelly, 1994).

Having an excess of heterogeneous agents can become a burden for the system if the solution to the problem requires a collective action. Computational modeling has demonstrated that beyond a critical threshold level, cooperation amongst the agents diminishes and becomes unsustainable (Glance & Huberman, 1994). However, if the agents are segmented into separate clusters, then they can act as assemblies of collaboration that can affect the system as a whole to transform.

A significant demarcation of a complex system from another system is the interactional process that transpires between its constituting agents. Such a process of

occurrence can be in the form of informational or material exchange and tends to be vivid and localized. As a result, agents within the surrounding localized branch also respond – along with being subjected to some rules and forces. Given that neighbouring agents are responding, yet are not aware of the macro-interpretation of the system and neither are there definite or exact states of coordination amongst the parts of the system, this can lead to a collective rise of a system level order that cannot be predicted based on having only the knowledge of the parts alone. Through the emergence of new-order at the system level, there is a downward causative force that influences other agents of the system through the same set of forces and rules (Maguire, McKelvey, Mirabeau, & Öztas, 2006).

Additionally, the nature of connection amongst the agents is an essential constituent of complex adaptive systems. The interactional rate amongst the agents at the intra-component level of the hierarchy is higher than between agents at inter-component level (Simon, 2002), resulting in the neighboring agents having a denser connection in comparison to distant agents. This offers the given level an insulation cover from the "rapid fluctuations of the lower echelons and the quasi-static constraints of the higher ones" (Huberman, 1989, p. 129).

With the interactional process between the agents being fundamentally non-linear in nature, this indicates that minute initiating factors can lead to excessively sizable effects in the state of the system (Hilborn, 2004). In other words, a complex adaptive system displays the symptom of 'butterfly effect' (Lorenz, 1963): refers to the flapping of butterfly wings in one region affecting the weather pattern in another region.

In ecological systems, not all agents can be connected to other agents. Particular species interact with a certain fraction of remaining species found in the ecosystem

(Kauffman, 1993). Likewise, in a social system, e.g. organization, the same holds true concerning the interaction amongst the agents. As such, the extent of the influence of the agents in a system depends on the intensification of connectivity. Such an interaction is epistatic in nature, which means that the fitness contribution of the system provided by an individual agent is dependent on the neighboring individuals while adapting to environmental demands. For instance, a new manager for a particular division is hired by the organization. Contributions of that manager as a leader, controller, enforcer and steward will depend on the degree of interaction with other members of the division; while provided with a general code of conduct, along with the capabilities and competencies of the new manager.

The feature of the distribution and connection within a complex adaptive system allows for improving the ability of error management. Kelly (1994) has observed that such "systems are built upon multitudes in parallel, there is redundancy. Individuals do not count. Small failures are lost in the hubbub. Big failures are held in check by becoming merely small failures at the next highest level of a hierarchy" (p. 22). Additionally, the hierarchical leveling in the system has the potential to discontinue the ripple effect caused by any unitary fault/flaw in the system. This can be seen in the way a brain functions. Minsky (1995) has observed that the functionality of the brain incorporates "a great jury-rigged combination of many gadgets to do different things, with additional gadgets to correct their deficiencies, and yet more accessories to intercept their various bugs and undesirable interactions" (p. 159).

2.7 Agents: Historicity and Feedback Loops

Since the structure of the complex system is dissipative, this provides space for the exchange of matter, material, information and energy between the system and its eco-system. The historicity of the path taken by such forms of exchange and chance events decide the end state of the system; thus, a system's "evolution depends on this critical choice" (Nicolis & Prigogine, 1989, p. 72).

Consequently, the emergence of new-order in a system is a representing remnant of the chosen path-dependency trodden by the agents of the system. As such, the form of history taken by the system is an important element in understanding the reason for such new form of order creation. The particular strand of history is co-governed by essential rules and forces, along with sequential patterns of chance events. Though much of the indeterminacy events do not lead to any substantial change in the present state of the system; however, certain accidents can solidify and lead to significant effects on the system (Gell-Mann, 2002).

The effectual stimulation – whether enhancement or diminution – through interactions occurs in the context of either positive feedback or negative feedback mechanisms. Commonly, the mechanism of positive feedback is the amplifying and reinforcing force while the negative feedback is an inhibiting and moderating effect. Both are needed for a system to remain active. For instance, "good investment can produce good returns (positive feedback), and overspending can result in a shortage in the money supply (negative feedback). Without feedback there would be no economic system—who would invest if there were no returns?" (Cilliers, 1998).

Therefore, the process of interaction amongst the agents through feedback loops, chance events, and a basic set of rules, influence development of new-order creations. Accordingly, the form of the whole entity is derived from the interaction of the component agents – which is greater than the summation of the parts. Consequently, the property of self-emergence of a system cannot be reduced only to its constituent agents or be predicted by only analyzing the individual agents (Checkland, 1981).

In addition, it needs to be recognized that a common impediment towards organizational learning is caused by positive feedback – which is known as the competency trap (March, 1994). This emerges when an agent can accumulate positive performances by using solutions that hinder it from using, potentially, alternative superior solutions. As such, the incentive to learn alternative solutions diminishes: even if the potential returns are superior (Levitt & March, 1988).

2.8 Contextual Setting: Factors Required for Co-evolutionary Dynamics

Differences amongst individual agents arise due to the paths chosen for reaching the stage of optimization. The landscape of the competition is another concern that changes the behavioral mode of the system. If the competitive ecosystem is considered as a fitness landscape in which there are varying degree of hills and valleys: the tallest peaks representing agents' optimal fitness reach, then we can visualize agents taking various routes to reach the maximum peak. This results in agents reaching different degrees of hills. Also, there can be a shift in the topography of the landscape (Kauffman, 1993; Gell-Mann, 1995b).

With the change of the landscape's topography, the result can be that an agent is thrown from its optimal peak level. However, this can increase the chance of the agent

reaching the landscape's global maximum peak. As such, changes in the landscape, or changes in the path of the agent towards reaching the peak valley can be considered as noises in the ecosystem that allow the agents to adapt effectively (Kelly, 1994).

Yet, it is also possible that such a change in the landscape or path taken can cause the ecosystem to become too noisy, resulting in the agent losing focus and not being able to respond adequately to the stimulus (Hübler & Pines, 1994).

For co-evolutionary dynamics to appear in a system the essential elements that are required are: agents need to be heterogeneous; agents require adaptive capability and be able to acquire learning; interactional relationship is possible between the agents; need for a top-down constraint that directs coevolutionary dynamics to induce agents to adapt to the changing ecosystem and an initiating event that allows for an interaction to materialize between the varying agents (McKelvey, 2002). Only when the stimulus can meet the threshold level/absorptive capacity of agent's responsiveness (Cohen & Levinthal, 1990) and there is connectivity between agents will co-evolutionary dynamics then start to appear (Brunk, 2000).

2.9 Agents: Forms of Co-evolutionary Dynamics

In an ecological landscape, co-evolutionary dynamics appear from the intensification of connectivity amongst the agents. Since an organism's ecosystem includes other organisms, any adaptive step taken by a particular organism alters the landscape of its neighboring organisms (Kauffman & Macready, 1995). As a result, the way an agent influences and in turn is influenced by other neighboring agents within a fitness landscape occurs through the process of co-evolutionary interaction. The emphasis then, in turn, is to be placed on the evolutionary progress of interaction and reciprocal adaptation (Futuyma

& Keese, 1992). Accordingly, within a complex social system, co-evolutionary interactional dynamics can affect the relationship amongst the agents and the institutional form of the system.

Co-evolutionary dynamics amongst the agents provide the possibility of a system to survive by making the system explore the spaces of possibilities within the two critical regions; i.e. at the edge of order and below the edge of chaos. As such, a single optimum strategy cannot act as an all-encompassing ideal scheme; rather, a strategy can be optimum only in a particularized condition. Therefore, changes in conditions require new forms of strategy.

Co-evolutionary dynamics can occur in multiple forms within a system. The most common tends to be the predator-prey relationship in which there is a cyclical process of increase in predator numbers leading to decline in prey numbers, which in turn causes predator numbers to decrease resulting in an increase in the numbers of prey at the population level (Sigmund, 1993). However, at an individual level of the agents, the faster the prey evolves, the faster the predator evolves, resulting in the prey evolving faster that in turn affects the predator to evolve faster. For instance: "The faster rabbits can run, the faster the foxes have to run; the faster the foxes run, the faster the rabbits run, and so on. The faster large firms buy up start-up firms, the faster start-ups and IPOs materialize; the more startups and IPOs there are, the more large firms can buy them up, and so on" (McKelvey, 2002, p. 3).

Competition amongst the agents in a complex adaptive system can also lead to the red queen hypothesis (Van Valen, 1973), in which an agent continually adapts in order to maintain competitive fitness against other competing agents. As such this means "that there

is a general tendency for microcoevolution to speed up. Therefore, it appears that sustained competitive advantage, especially in a world of changing taste, technology, and globalization, is fundamentally a function of advantage resting on being able to speed up micro coevolutionary processes" (McKelvey, 2002, p. 4). Such a speed up of co-evolutionary dynamics tends to occur amongst those agents that are competing for similar resources (Heylighen & Campbell, 1995).

2.10 Co-evolution: Managing the Dynamics

According to McKelvey (2002), Ehrlich and Raven (1964) were the first to come up with the term 'coevolution'. According to them the process of coevolutionary dynamics meant to examine "patterns of interaction between two major groups of organisms with a close and evident ecological relationship" (Ehrlich & Raven, 1964, p. 586). However, "they did not define coevolution" (Janzen, 1980, p. 611), and as far as this author is aware, the first person to actually define co-evolution was Janzen (1980), who stated it "as an evolutionary change in a trait of the individuals in one population in response to a trait of the individuals of a second population, followed by an evolutionary response by the second population to the change in the first." (p. 611). Consequently, co-evolution becomes the root process through which the system manifests self-organizing behaviors (Arthur, 1999; Kauffman, 1993).

What is also important to realize is that the process of co-evolutionary dynamics is a "mutual-causal, deviation-amplifying, positive feedback process… Thus, A reacts to B; B reacts to A; the deviation-amplifying cycle repeats indefinitely until some damping mechanism halts it" (McKelvey, 2002, p. 1). Consequently, it can also lead to a decline in unique insights and bring about group-thinking (Janis, 1972).

From coevolutionary dynamics, new-order creation comes into existence. However, if not controlled then it can lead to chaos and a greater degree of disorder; too little coevolutionary dynamics, then the system cannot adapt to the changing landscape. These are the two problems that McKelvey (2002) has mentioned as "too little of it and too much of it" (p. 8). As such, he ponders: "If coevolution is good, how to speed it up? If it is bad, how to slow it down or stop it altogether? (p. 8).

2.11 Damping Mechanism

A damping mechanism is an adjustment tool by which the rate of co-evolutionary dynamics is managed. For example, if the damping mechanism of cost-control occurs too soon in a new product development, then the creational process and knowledge distribution that results from the co-evolutionary dynamics will be impeded and new-order creation will not emerge (McKelvey, 2002). Discussing the importance of damping mechanisms, McKelvey (2002) has touched upon the general forms of damping mechanisms that occur in a system: loss of agent heterogeneity; loss of weak-tie fields; failing human capital (nodes); senescence due to longevity; growing complexity catastrophe; loss of coupled dancing; separation from contextual drivers; disconnection from adaptive tension and critical values; corrupted weak-tie fields; boiled frog effects; and self-organized micro defenses against coevolution. Extrapolating from the types of damping mechanisms suggested by McKelvey (2002), Usher (2014) has considered the types of damping mechanisms that might prove useful for managing emerging order in an educational system: loss of agent diversity; loss of weak-ties; network failure at the nodes; and separation from adaptive tension. The logic behind selecting these four was the intention to set the machinery at the highest possible level, i.e. above the level of individual

organizations. Since these four damping mechanisms will be utilized as adjustment tools later on the object of study, I will now discuss them.

First, a system that does not have heterogeneous agents will not be able to respond constructively to changing drivers of the eco-system. It is necessary for the system to demonstrate having diverse agents by reducing the effects of such inhibitors as strong top-down leadership approach and bureaucratic structures. In addition, the linkages that are then formed between heterogeneous agents enhances the system's adaptability to uncertainties of the eco-system (McKelvey, 2002).

Second, the issue of weak-tie field is closely coupled with agent heterogeneity. If weak ties amongst the agents turn into strong-ties, then this diminishes heterogeneity amongst the agents. As a result, there is a decline of novelty production and entrepreneurship due to strong cliques, diminishing cross-boundary communication, and increasing collective threshold gate level that lead to discontinuous connections amongst the agents (McKelvey, 2002).

Aside from managing the density of the connectivity amongst the agents, another capacity that needs to be maintained is the issue of nodes-capacity. It is possible for a system to lose its ability to generate self-organizing dynamics due to diminishing capability of the agents to adapt and innovate; thus resulting in the system losing its novelty production capacity (McKelvey, 2002; Cohen & Levinthal, 1990).

In order for co-evolution to produce useful outcomes for the system, it is essential that agents be under pressure to adapt to some contextually imposed problems. There is a possibility that the coevolutionary process that is occurring within a system is disconnected

from the adaptive tension. It then becomes necessary that key agents in the system are supportive of the imposed adaptive tension (McKelvey, 2002).

2.12 Complexity Science: Application in Organizational Settings

The choice of organizational systems that will be presented in this section are human-integrated systems that have been studied in the light of complexity science. Those examples are taken in which the aim of the authors have been to gain greater insight into system's dynamics or deriving practical implications for organizations through the application of complexity science. Moreover, I will be providing examples of empirical sites from different themes of organizational studies to showcase potential contributions that researchers can gain by using complexity science on human-integrated systems. I, will firstly, begin with leadership, and then move to following topics: entrepreneurship, production system, organizational transformation, medical sector, and, lastly, educational sector.

2.12.1 Complexity Science: Leadership

With the limited success of traditional leadership approaches in adapting to changing challenges in the ecosystem, organizational scholars have directed their attention towards utilizing the concept of complexity leadership theory that seeks to address the issues of adaptive challenges. For instance, Uhi-Bien, Marion and McKelvey (2007) have utilized complexity science to develop a broad conceptual framework that encompasses three intertwined role of leadership: "adaptive leadership, administrative leadership, and enabling leadership" (p. 298). As such they showed that the function of leadership becomes a "complex interactive dynamic through which adaptive outcomes [e.g., learning, innovation, and adaptability] emerge" (p. 314).

In addition, complexity science suggests that leadership actions produce effects within the matrix that influences agents within the particular level through connectivity between the agents. Moreover, leadership events can spark off emerging nodes in the social grouping, and through instigating tension, there can be production towards adaptive change that addresses organizational challenges (Uhi-Bien et al., 2007).

Complexity science indicates that leaders need to develop competencies that are based on complexity. This means that the focus is more towards managing organizational dynamics and enabling initiatives that are not formal. It is not about escorting members of the organization to follow a unitary direction but to allow idiosyncrasy in the behavioral pattern and allow the collective members' aggregate sum of thoughts to challenge evolving issues. As a result, the aim of the leader is to contribute towards the interactional dynamics of the agents that can lead to new-order creation, organizational learning, and adaptive capability (Hanson & Ford, 2010).

The science of complexity has also been applied to the issue of understanding how leadership assists in expanding adaptive behavioral growth in the system. Studying Mission Church and its decision-making process through complexity perspective, Plowman et al. (2007) were able to show that good leaders are those that can "*destabilize* rather than *stabilize* the organization" (p. 354, authors' emphasis). This meant that they did not lay down a desired state that resulted in changing the organizational structure. Rather, the role is to move the system towards far-from-equilibrium position through introducing vagueness in order for new-order creation to emerge.

Secondly, coherence is to be maintained through interpretation of the process and providing content to the emerging new order. Also, pressure to innovate is not as much

emphasized as encouragement for innovation to occur. Through fostering non-linear interactions, production of innovation becomes the domain of the group rather than just the leader. Additionally, by playing a prominent role in providing elucidation and sense to continuous changes and events, the role of the leader becomes more to do with "interpret change rather than create change" (p. 354). Moreover, positive change and effectiveness in an organization comes not only from managing people but also requires leaders to "manage words" (p. 354). This means they "are intentional about the language they use to help people understand what is happening in the organization" (p. 354).

2.12.2 Complexity Science: Entrepreneurship

Complexity science has also been used for researching issues related to entrepreneurship. For instance, Lichtenstein, Carter, Dooley, and Gartner (2007), using theoretical implication and methodological procedure of complexity science, were able to study the "dynamic patterns… which were undertaken by nascent entrepreneurs in the Panel Study of Entrepreneurial Dynamics." (p. 236). They suggested that if certain conditions are met by the distinct dynamical interactions of initial activities, then the emergence of a new firm can be materialized. They are: "the rate of start-up activities is high, start-up activities are spread out over time, and start-up activities are concentrated later rather than earlier over time." (p. 236).

2.12.3 Complexity Science: Production System

Organizational scholars have studied production systems through the lens of complexity science. Such systems are complex as its processes are characterized by non-linear interactions (Leonard-Barton, 1988), and which generate revenues through the transformation of inputs into outputs (Heizer and Render, 2009). In the study of Tyre and

Orlikowski (1994), two of the research sites "were complex production systems" (p. 113). In such systems, they were able to observe that technology adoption tends to be "distinctly discontinuous, or episodice… While full integration of a new technology may take several years, adaptation attention and effort are not applied consistently over that period, nor do they taper off gradually. Rather, they are concentrated in short spurts during the period" (p. 113). Their finding suggested that what appears to be constant improvement in the systems can be considered as being "the sum of discrete episodes of adaptive activity carried out at different times and applied to different technologies" (p. 113).

2.12.4 Complexity Science: Organizational Transformation

Pascale (1999) has explained how Royal Dutch Shell did a radical organizational transformation by using the principles of complexity theory. He mentioned that the transformation was done in such a way that the emerging project was able to produce informal connections – numbering hundreds – between the head office and the field: resembling like the neural network of the nervous system in the brain. Also, by moving towards the edge of chaos region through several distinct elemental designs, stress was intensified on the members of the organization. This occurred when the "… top team performed … teaching and coaching wave after wave of country teams. When the lowest levels of an organization were being trained, coached, and evaluated by those at the very top, it both inspired — and stressed —everyone in the system (including mid-level bosses who were not present)" (p. 92). Also, this resulted in making the members integrate with each other in a "more direct, informal, and less hierarchical way of working" (p. 92). This was made possible because leadership fostered "the vision and are the context setters" (p. 93).

However, the solutions that can best meet the evolving strategic challenges of the ecosystem are to occur through the actions of individuals who are closest to them. Thus, the responsibility of a leader is to be "a context setter, the designer of a learning experience — not an authority figure with solutions" (p. 93). This will then allow junior ranked individuals of the system to realize that they own the problems of the system, leading them to "discover that they can help create and own the answers, and they get after it very quickly, very aggressively, and very creatively, with a lot more ideas than the old-style strategic direction could ever have prescribed from headquarters" (p. 93).

2.12.5 Complexity Science: Medical Industry

In the medical field, complexity science has been used for addressing "public policy, clinical and management challenges of health care" (Zimmerman, 2011, p. 617). For policy-makers, complexity science has provided a new way to understand that generic public policy cannot be defined isomorphically at the local level. Consequently, localized solutions are required. For instance, "the National Health Service (in the UK) has used design principles inspired by complexity science…while the Institute of Medicine (in the USA) has drawn upon complexity science to understand and address quality shortcomings in healthcare delivery" (p. 617). Moreover for clinical science, studies using complexity science have focused on "relationship-centered care to using fractal geometry for diagnosis and treatment of cardiac conditions." (p. 617).

Regarding managerial style in public systems, complexity science has shown that robust strategies that essentially are adaptable to changing fitness landscape are substituting optimizing strategies. Moreover, there is a broad recognition (as occurred in National Healthcare Service in UK) on steering away from centralized mechanisms and accepting

that these systems do have the potential to self-organize. Also, greater emphasis has been placed on the interactions that exist between the agents of the system in order to improve the health of the system. (Lempert, Popper, & Bankes, 2002)

Zimmerman and Ng (2008) presented a framework for health public policy that contrasted between viewing the system as having traditional mechanistic processes and a system that has complex interactions. They noted that viewing a system through complexity science changes ones' perspective, planning, implementation and evaluation of public policy. Consequently, the change in conceptual understanding of health public policy, through complexity science, brings about five specific managerial strategies in health system: sense making, remembering the history of the system, pondering about future scenarios, unexpected disruption resulting, and undertaking action with unfolding of circumstances (McDaniel & Driebe, 2001)

It is essential that leadership be able to ensure that the system can co-evolve with the changing conditions of the landscape so that the healthcare system improves. Consequently, by using the principles of complexity science, Fraser and Greenhalgh (2001) have suggested that emphasis on competencies (e.g. skills) is not enough but also the need to put more emphasizes on acquiring capability (e.g. adaptability, creation of new knowledge and improvement of performance). This can occur through feedback loops or through the application of non-linear manner of imparting education, i.e. storytelling. As such, the process needs to be dynamic and lack prescriptive goals.

2.12.6 Complexity Science: Educational Industry

In educational systems, McMillian (2004) has described the changes that occurred at the Open University, UK, between 1993 and 1996 through complexity science. Initially,

the program for organizational transformation rested on a deliberate strategy that later on progressed to becoming emergent and consensus strategy. It was not driven by the top echelon of the system; rather, evolved through the consequences of multiple interactions that were occurring amongst the agents.

The emergence of new-order creation in an educational system is contingent on the system's landscape exhibiting distinct – yet simultaneously interrelated - conditions. Scholars of complexity science describe these interdependent conditions as being three sets of complementary pairs (Davis & Sumara, 2006). They have described these conditions being embedded in the landscape of the complex system and orchestrate the system in the region of complexity; thus, the system retains its ability to generate co-evolutionary dynamics.

New-order creation emerges in a complex system when the system exhibits conditions of three sets of complementary pairs: specialization – the existing tension between internal diversity and internal redundancy; trans-level learning – enabling interactions amongst agents through decentralized control; and enabling constraints – balancing randomness and coherence (Davis & Sumara, 2006).

These three sets of complementary pairs form the foreground, context and setting in the system that allow the emergence of amalgamated possibilities and innovative genotypes at distinctive edges of the organizational spectrum. Consequently, by acquiring value-enhancing capabilities, it becomes possible for the system to adjust continuously, respond, and adapt to the various drivers of the ecosystem.

On account of these conditions being interdependent and complementary with each other, connection and linkage are formed between the activities of the nearby agents and

with the global attributes and properties of the system. Consequently, various arrangements that are initially formed due to personal aspirations of the agents are then transformed into a unified echo of grander collective possibilities so that the system may achieve its ultimate outcomes and objectives.

Such differential orderings are the product of diverse summation of networking that branch/spread between the agents of the system. For this to happen it is essential that agents be given the opportunity to take a collective decision, not coerced into choosing an interpretation, and facilitated to arrive at a conclusion based on collaboration between themselves. Accordingly, the system will then stand to function as a self-organizing system.

The amount of internal diversity present in a system is reflected by the range and forms of conceivable responses that the system can offer depending upon the degree of heterogeneity present amongst the agents of the system. If the structure of the system is managed by emphasizing on a minimize-focus approach towards interactional arrangements between agents, then there is a greater likelihood that the condition of internal diversity within the system will reduce. In turn, this will diminish the capability of agents to initiate co-evolutionary dynamics with the result being that there will be a negative reverberating impact on the system's health. Consequently, the system will have a reducing level of competency to form novel-arranging behaviors that will make the system less receptive to the drivers of the ecosystem.

The complementary condition to internal diversity is internal redundancy. With this arrangement, the system holds extra-variance that matches the ambiance of variance found in the landscape of the ecosystem. Some researchers of complexity science suggest that a

system's variance should be greater than the variance found in the external environment. In either situation, the target is to have a system that displays the condition of internal redundancy alongside internal diversity.

Standard books on organizational studies define redundancy as an attribution/process of a system that is present excessively in the system beyond the required level; which in turn, is linked to higher costs and a cascade of declining efficiency in the operations of the system. Perhaps this notion draws a fine-tuned picture about organizations that display simple mechanisms and processes. However, favorable co-evolutionary dynamics transpire in a complex system when the system exhibits duplications and excesses of agents and resources.

The condition of internal redundancy provides two functions when coevolutionary dynamics forms new-order creation: commonality and compensation amongst the agents of the system. The commonality amongst the agents of the system enables the opening of multi-porous channels that then allow the flow of information and interaction between the agents. In addition, if one of the agents were to lose its functionality or have diminished performance capability, then such a situation provides the chance for the nearby and localized agents to react and compensate for the failing performance and diminished effectiveness of the deteriorating agent.

Consequently, we observe that there is a back and forth channel of a continuous dialog between internal diversity and internal redundancy. The condition of internal diversity encourages enhancement in variation – within the system – and is outward-oriented: enabling the system to arrange for novel possibilities in response to changing dynamics of the ecosystem. Meanwhile, the condition of internal redundancy, systemizes

and solidifies the routine and habituated interactions amongst the agents of the system and is inward-oriented. Therefore, continuous dialog between these two conditions forms a correspondence that acts as a balancing influence between the sources of new-order creation and the sources of stability in the system.

As such, the pairing of internal diversity and internal redundancy generates a heightened response by the system to direct the actions of individual agents while being anchored to the collective needs and objectives of the system. Such a force of direction focuses the idea that in a complex system, equity is not linked with the concept of providing uniformed or identical opportunity to individual agents. Rather, equity in the complex system is understood as providing a favorable context and setting in which different agents can pursue such course of actions that are interconnected to the ultimate outcomes of the system.

Davis and Sumara (2006) have given a novel interpretation of the nature of neighbor interactions in a learning system. According to them, the nature of neighbor interactions in a learning system is not to be confused with the number of physical entities or social spaces in the system that enable interactions between agents. Rather, neighbor interactions, in the context of a complex learning system, are points of contacts between ideas, notions, mental models and prototype schemata between agents of the system. These forms of interactions have the potential to translate into actual actions, which then continuously evolve and become more developed. Such an occurrence is possible because various agents during the process of neighbor interactions gain accumulated experience and greater appreciation of the emerging notion. Accordingly, the resulting integrated expression appear in the system as forms of written statements and conceptual framework.

The complementary condition to neighbor interactions is decentralized control. Such a condition refers to the notion that if c-oevolutionary dynamics are to transpire and produce new-order creation in the system, then it is essential that agents within the structure and hierarchy of the system relinquish any desire to control the process, mechanisms and outcomes of the system. It does not mean that there should not be a constituent that organizes proceedings, facilitates episodes of interactions, and encourages dialog between agents. Rather, what is meant in the context of complexity science is that multiple-interpretative possibilities – that result from neighbour interactions – are not to be constricted, or that one interpretation chosen as the optimum explanation by agreement amongst a few selected agents. Synonymous to decentralize concept is the idea of sharing in complexity science. As such, selecting the kind of interpretation and taking a decision on the choice of actions is done through the consensual domain of authority. It is possible that external authorities may present interpretive possibilities to the system; however, the system decides what course of action is to be taken towards reaching the ultimate outcomes of the system.

The structural design of the system plays a prominent role in mediating the sources of coherence and sources of randomness: balances the act of collective focus to maintain comprehensive strategy of the system with constant adjustment and adaptation of the system's setting to the drivers of the eco-system. Such a bi-contextualization of the system provides two important functions: enabling coherence and stability in the system, and generating randomness and noise in the landscape of the system so that the emergence of new-order creation may occur.

The diction of rule-bound constraints of the system to the agents is essentially proscriptive; rather than prescriptive. It refers to the assumption that the low-level rules guide the agents within the system to avoid those arrangements that may dampen the viability of their functionality. If such configurations transpire, then the resulting failure would be the diminishing capacity of the agents to form emerging order in the system. It would then remove the system from the region of complexity.

3 Methodology

3.1 Traditional Approach: Social System

Historically, research approach in the disciplines of social sciences have been grounded in the framework of positivism. For naturalist scientists and policy-makers, the approach of interpretive constructivism is considered as a work of journalism whose contributors are reckoned as being soft (Huber, 1995). Asides the assumption of delineating a boundary between real knowledge from soft science, the reality of a phenomenon is considered as being unitary, constant, and stable form that is unadulterated from the subjective perception of individual beings.

Emanating from such an approach is the belief that precision in results can only be derived by applying quantifiable methods on a sampling set that will then transform into becoming statistically significant with the real population. David Hume (quoted by Kimball, 1986, p. 129) put it bluntly that if any approach which does not contain "experimental reasoning concerning matter of fact and existence… Commit it then to the flames: for it can contain nothing but sophistry and illusion." Such a line of reasoning assumes that knowledge can only become scientific if it provides measurement, and the pinnacle of the methodological approach to generating scientific value originates from statistics (Ogburn, 1930, 1932).

From the early part of the 20th century, scholars of social sciences started investigating the limitation of the statistical procedure in understanding complex systems. For instance, Blumer (1956) questioned the usefulness of incorporating variables to human interactions. He argued that those variables that are employed by quantitative researchers were those variables that cannot be classified as generic: selected variables have been

rooted in a particular cultural and historical context. In addition, from the framework of independent-dependent variables, there is greater likelihood of concealment of real interactional dynamics amongst the agents of the system because leaving "out the actual complexes of activity and the actual processes of interaction in which human group life has its being…, and the real interaction and relations between such factors" (p. 689).

Dealing with such issues, there was a greater sense of recognition that that when dealing with the ontological aspect of a phenomenon in social sciences there needs to be a heightened sense of acknowledgement that the reality of an object is associated with "the creative imagination of social beings" (MacIver, 1931, p. 27). Furthermore, more emphasis needs to be placed on understanding "systems of relationship, not series of quantities" (p.30). As a result the question put forward is: How can the quality of human relationship "be apprehended by so crude an instrument as statistics?" (Burgess, 1927, p. 111).

Traditional statistical methods for studying complex social systems are only able to provide limited insight as to how and why a system behaves in a particular mode; thus, "our most useful tools for generalizing observations into theory—trend analysis, determination of equilibria, sample means, and soon—are badly blunted" (Holland, 1995, p. 5). For instance, reflecting the characteristics of complex adaptive system having heterogeneous agents with their peculiar adaptive threshold level cannot be measured by average summation. Therefore, a leap towards accepting transcendental realism that incorporates relativist ontology – recognition of a singular reality having multiple facets, and subjectivist epistemology – in that the boundary is blurred between the researcher and the subject, are starting to emerge amongst scholars of social sciences.

3.2 Analyzing Complex Adaptive System: Foundational Approach

Rudimentary form of qualitative research can be traced back to ancient Greece; for instance, "Sextus Empiricus conducted a cross-cultural survey of morality, showing that what was considered right in one society was considered wrong in others… from the accounts of travelers…" (Erickson, 2011, p. 43). In its contemporary reincarnation, the qualitative research examines emergence and shaping of knowledge as arising and being modulated from an interpretive approach that a researcher takes. As such, there is an acceptance that reality is a construction of an individual's creative power; the intimate relationship that exists between the observer and the observed is shaped and influenced by social constructs and situational limits.

The defined aim is not to abide by a particularized methodological procedure or present universal proclamation of certainty but to accept that human consciousness plays a prominent role in the acquisition of knowledge. Therefore, the site of study is then interpreted through meanings and processes that emphasize the quality of the subject, rather than on measuring variables through quantification.

Using the approach of the case study allows a researcher to generate understanding of complex adaptive systems: insights about interactional dynamics that occur between the agents of the system are provided. Such an approach has widely been used in different disciplines of social sciences, i.e. psychology, sociology, business, public administration. (Yin, 2003).

A general misconception that abounds amongst novice researchers is the assumption that case study is utilized only for exploratory investigation of a phenomenon;

only the experimental design imparts the necessary findings for inferring explanation and causality (Yin, 2003).

However, the case study approach can also be employed as an explanatory model. What is required are three conditions to be met. These conditions are associated with: "the type of research question posed, the extent of control an investigator has over actual behavioral events, and the degree of focus on contemporary as opposed to historical events" (Yin, 2003, p. 5).

In consequence, if the nature of research question is related to 'how' and 'why', researcher does not require to control or manipulate behavioral events in the research setting, and a focus is on a contemporary phenomenon, then the preferred choice is case study as a research design (Yin, 2003).

Harré (1979) proposed that a case study can be bifurcated into being either extensive or intensive in nature. The focus of intensive case study is to comprehend dynamisms of the case through a framework of holistic and reviewed narration that involves thick description and contextualization of the research site (Geertz, 1973). Hence, an important aspect of this approach is the utilization of verbalized interpretations that provide the researcher a clarified perspective to understand the vivid and multidimensional details of the study.

Thick description provides elaborative meanings of activities in the object. Consequently, the researcher of the organizational setting then is the interpreter who pieces together different threads of the case, and then analysis through reviewing the contextual dynamics embedded in the case. Therefore, a case study research is an approach that provides in-depth understanding of the real contextual situation of the contemporary

phenomenon that is being observed. Moreover, it allows the researcher to define the boundary of the event, along with its surrounding contextual dimensions.

Through the approach of the case study, a researcher can extract the presumed causal relationship between real-life interactions that by nature are excessively complex to understand by means of the experimental process. In addition, the intervening effect on the interaction between the agents within the contextual situation can be described. It can also provide, secondly, evaluation of the case through description. Moreover, this approach, lastly, allows the researcher to elucidate the situations in which an intervening effect can provide multiple outcomes (Yin, 2003).

However, to proceed with the case study approach requires an *a priori* theory that would enable the researcher to juxtapose the empirical data with the theoretical construct: mapping of a theoretical framework provides the researcher a "story about why acts, events, structure, and thoughts occur" (Sutton & Staw, 1995, p. 378). Furthermore, an *a priori* theory provides a stable and steady guide for what data is to be collected, the approach required for analyzing the empirical site, and generates heightened meticulousness during the phase of interpreting data (Yin, 2003). In addition, the nature of the relevant theory decides the rationale for the choice of the case study. If the theoretical framework is holistic in nature and the focus is not specifically at the operational level, then the choice of case study is singular and holistic; hence, a single-unit analysis (Yin, 2003).

3.3 Analytical Approach: Functionality of Theory

Aligning an *a priori* theory with the empirical site is an important component of research design in an intensive case study. Such an arranging process seeks the continuous

attention of the researcher and occurs in the form of abductive approach (Dubois & Gadde, 2002). Moving in this way allows progression towards generalization that emerges when readers can resonate their experiences with the empirical data and theoretical constructs of the case study (Stake, 1995).

Hypothetical induction, also known as abduction, retroduction and inference to the best explanation (Jupp, 2006, p. 146) is a convincing approach that is taken to ensure that a constant exchange of information and dynamical interaction between theoretical constructs and empirical data materializes. The central premise of the process of abduction is the acknowledgment that cognitive inference becomes a legitimate process for observing, gathering and analyzing the data. As such, the inference of what is observed is then taken from the most suitable explanation that has the underlying theoretical framework and is applicable to other cases. It is one of the basic reasoning tools that is used in ordinary situations and scientific analysis; as a result, the best explanation is elegant due to its simplicity, alignment with the *a priori* theory and ability to abide with Occam's razor.

Such a style of reasoning is considered to lie in the domain of interpretive scholarship (Hatch & Yanow, 2003) and tends to have lesser uniformity for providing a normative methodological process (Wodak & Meyer, 2009). When analyzing an empirical site through the process of abduction, and within the theoretical-conceptual framework, hermeneutic circle becomes the operational basis for the occurrence of dialog between the interpreter's pre-conceived notion of understanding the phenomenon and the data that is derived from the empirical site. Therefore, cognitive inference becomes a legitimate tool of research methodological procedure. Moreover, the focus then shifts from not producing evidence on which the manager ought to take action upon but to "help the practitioner in

the process of producing and interpreting such evidence" (Mantere & Ketokivi, 2012, p. 84).

3.4 Analytical Approach: Validity and Reliability

Ensuring internal validity is a concern in any explanatory case study. The requirement for a researcher is to substantiate that the explanation given for the causal interaction between two agents is concluded correctly. In addition, proper inference needs to be drawn regarding the occurrence of the event; in a case study approach, pattern-matching is applied that compares "empirically based pattern with a predicted one… [And] if the patterns coincide, the results can help a case study strengthen its internal validity" (Yin, 2003, p. 116).

External validity is another concern that needs to be dealt in the case study; in other words, can the findings of the research be generalized and applicable outside of the immediate research site? These types of questions have been contentious amongst scholars with "critics… implicitly contrasting the situation to survey research, in which a sample is intended to generalize to a larger universe." (Yin, 2003, p. 37). However, they fail to recognize that unlike in survey that is dependent on "statistical generalization… case studies (as with experiments) rely on analytic generalization. [And] in analytical generalization, the investigator is striving to generalize a particular set of results to some broader theory" (Yin, 2003, p. 37).

The concern of reliability in a case study is not linked to the meaning of replicating same results from another set of case research. Rather, it means, that if another researcher were to thread the steps taken by the initial researcher and carefully observe the sequential steps taken during the research of the case, then the conclusions derived from the repetitive

study should be similar to the previous findings of the case study. Consequently, the initial researcher needs to ensure that the documentation of the research is systematically done so that others researcher can test the reliability of the case. In other words, proper steps are to be taken that clarify the research design and the methodology of conducting the empirical site in such a way that other individuals can audit them.

3.5 Analytical Approach: Evidentiary Process

Documentation usage is one of the primary evidentiary sources in a case study research. Having many forms, it can appear as letters, minute of meetings, proposals and other forms of written reports. By playing an explicit role during the data collection phase, it serves as a replacement for those activities that are not possible for the researcher to observe (Eriksson & Kovalainen, 2008). Additionally, its strength lies in being: stable, reviewed repeatedly; unobtrusive, separate from the reasoning behind the rationale for research; exact, details of the event and names of individuals; and broad coverage, covers durational period, multiple settings and several occasions (Yin, 2003).

Analyzing an empirical site through the case study research relies on "theoretical propositions" (Yin, 2003, p. 111) and "developing a case description" (Yin, 2003, p. 114). The first step allows the shaping of data collection; managing the analysis of the case study; and providing the researcher to accept certain data while rejecting other data. The second direction then specifies the descriptive framework through which the case study is organized. As such, the structuring of the descriptive framework offers the range of topics that are relevant to the research; hence, the descriptive framework guides the researcher during the analytic part of the study.

3.6 Analytic Framework for Theory: Induced and Autonomous Strategy Processes

Having an *a priori* theory for studying Campus Alberta as a complex system is required and which will then guide me to describe and analyze the research site. Consequently, the *a priori* theory that I have applied is Burgelman's "evolutionary framework of the strategy-making process" (Burgelman, 2002, p. 9). Burgelman's Model was presented in chapter 2, and I believe that it can be operationalized through the elements of complex adaptive system thinking that have been presented by McKelvey (2002). Subsequently, these two sources will guide me during my study of Campus Alberta.

4 Findings

The foundational reasoning positioned in the present research is based on the *principium* of interpretative scholastic approach rather than a normative methodological *modus operandi*. Prior to detailing the process of collecting and analyzing data, I will briefly summarize the approach I have taken in this study so that the readers may become acquainted with, and cognizant of, the rationale behind the choice of the documents that have been employed for this study.

With the approach being embedded in the paradigm of qualitative research, there is heightened sense and greater acknowledgement among scholars that in this case the epistemology of a subject is construed within the framework that the researcher has outlined for the study. This means that the object of the study is conditioned/contingent on interpretative analysis by meanings and processes that emphasize the qualitative dimensions of the study.

The present work on Campus Alberta is categorized in this research as an intensive case study. Consequently, this results in putting greater emphasis and attention toward comprehending the interdependency dynamics of Campus Alberta through a framework of holistic and reviewed narration. Accordingly, by being provided with thick description and contextualization of Campus Alberta, the outcome is a verbalized interpretation that delivers greater clarification and meaningful understanding of the multi-dimensional components of Campus Alberta rooted at the level of system observation.

To proceed with such an approach requires an *a priori* theory. An *a priori* theory provides the researcher a steady guide for what data is to be collected, the approach needed

for analyzing the data from the empirical site, and also develops heightened meticulousness and diligence during the phase of interpreting data.

The channel that connects an *a priori* theory with the empirical site is hypothetical induction, which is also known as abduction, retroduction and inference to the best explanation. The central premise of hypothetical induction is the notion that the usage of cognitive inference becomes a legitimate means to be utilized for observing, gathering and analyzing the data. This means that the inference of what to be observed is taken from the most suitable explanation that has an underlying theoretical-conceptual framework. In other words, the best explanation is elegant due to its simplicity, alignment with the theoretical underlying structure, and ability to abide with the Occam's razor.

The *a priori* theory that I have applied and exercised in studying Campus Alberta is the intra-organizational evolutionary framework of strategy-making process by Robert A. Burgelman. Henceforth, in the remaining section of the research I will designate this *a priori* theory as 'Burgelman's Model'. After applying Burgelman's Model, the interpretation of the findings will be shaped by McKelvey's (2002) work on complex adaptive system thinking. In other words, a critical insight drawn from this research will be the integration of Burgelman and McKelvey by casting aspects of the latter as operationalizations of the former.

Burgelman's Model has provided me a stable and steady guide as to what data needs to be collected. The analysis of the data is done through the hypothetical induction process and within the framework of Burgelman's Model. This has resulted in a hermeneutic circle that becomes the operational basis by which there is an occurrence of

dialog between my pre-conceived notions of understanding a phenomenon; through a theoretical formulation, with the data that is extrapolated from the empirical site.

For the purpose of understanding the process of collection and analysis of the data, I begin by, briefly, summarizing the central aspects of Burgelman's Model. A more comprehensive description of Burgelman's Model was provided in chapter 2 of this research work.

Burgelman's Model presents two generic categories of strategic behavior that are distinctive a large complex system: induced strategic behavior and autonomous strategic behavior. Induced and autonomous strategic actions correspond with the notion of variation in the organizational system. In the induced strategy process, there is the structural context determination while within the autonomous behavior process there is the strategic context determination. Emerging of new order is an initiative that is outside the scope of the comprehensive strategy and is evaluated by the strategic context determination; induced strategic action is an effort that fits with the concept of comprehensive strategy and is evaluated by structural context determination: The dominant functionality of both contexts correspond to the idea of selection in the system. Were the structural context deals in months to achieve commercial viability, the strategic context allows years for ideas to bear fruit. Constraints are proscribed, i.e. broadly defined in terms of scope limits, rather than prescribed as aligning with existing strategy. The strategic context is a maker's space in which to innovate, an experimental test bed, a skunk works. It has slack resources that are independent of standard audit lines. It has sufficient disassociation from the primary culture of the system that it can incubate potentially disruptive and radical changes to the system

itself. Lastly, the concept of comprehensive strategy corresponds to the perception of retention in the organizational eco-system (Burgelman, 1983, 2002).

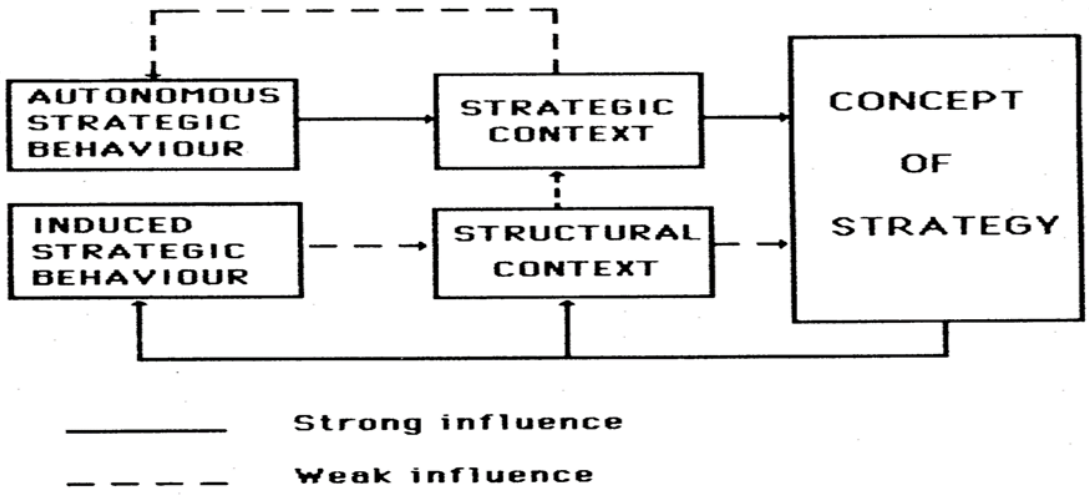

Figure 3. Burgelman's Model. Sources: Adapted from (1) R. A. Burgelman, 1983, A model of the interaction of strategic behavior, corporate context, and the concept of strategy (p. 65), Academy of Management Review, 8: 1; (2) R. A. Burgelman, 2002, Strategy Is Destiny (p. 9), New York, USA: The Free Press.

4.1 Burgelman's Model: Corporate Strategy

In the intra-organizational evolutionary framework of Burgelman's Model, the notion of corporate strategy is about the theoretical understanding that the top echelon of an organization has about the reasons for the past successes of the organization and the anticipated causes for future successes. Consequently, a common frame of reference is provided which underscores the unique competencies that the organization has, the segment of the industry in which the organization can succeed, values for which an organization stands for, and the objectives that an organization tries to achieve (Burgelman, 2002).

4.1.1 Comprehensive Strategy of Campus Alberta

The generic frame of reference in Burgelman's Model as to what constitutes a comprehensive strategy guided me when looking at the documents that are related to the Campus Alberta. Since the *a priori* theory is Burgelman's Model, and the hypothetical induction is the process of connecting data to an *a priori* theory, this meant that I needed to look into documents that are related to the comprehensive strategy of Campus Alberta. Therefore, I have studied, and then interpreted, documents that were available on the web link of Campus Alberta and were consistent with presenting an outline of the comprehensive strategy of Campus Alberta. As a result, the following documents were studied to provide a better understanding of Campus Alberta's comprehensive strategy: (1) Campus Alberta: Policy Framework (Alberta Learning, 2002), (2) A learning Alberta (A Learning Alberta Steering Committee, 2006), (3) Roles & Mandates (Alberta Advanced Education and Technology, 2007), (4) Post-secondary Learning Act (Province of Alberta, 2003), and (5) Campus Alberta Interim Strategic Plan (Alberta Government, 2014).

With the appearance of the 'Campus Alberta: Policy Framework' document in 2002, Campus Alberta emerged as a key framework/model with the potential to provide Albertans equal opportunities of seeking and attaining their lifelong ambition to learn. The document advocated the need to facilitate opportunities for Albertans to acquire higher learning thereby placing greater emphasis on the following: transforming the economy of the province into a knowledge-based economy, acknowledging the effects of globalization, utilizing the full capacity of potential and existing workforces, establishing a conducive environment for instilling democratic values, and providing the opportunity for individuals

to fulfill their lifelong learning objective and achieve personal fulfillment (Alberta Learning, 2002).

Consequently, a new way of thinking about how to provide lifelong learning to Albertans transpired in the advanced post-secondary system of Alberta in that individual institutes of higher learning were encouraged to collaborate to ensure that quality and innovative learning opportunities are delivered to Albertans, and that social cohesiveness, cultural integrity and economic well-being of the province are maintained and enhanced. Accordingly, a new set of linkages emerged between the stakeholders of Campus Alberta (Alberta Learning, 2002).

The document highlighted that outcomes derived from Campus Alberta would positively affect Albertans by providing greater opportunities to acquire relevant learning, reducing impediments that exist for Albertans to enter/transfer within the advanced educational system, and ensuring resources are being utilized effectively for developing a better Alberta. For this to be attained required transforming the post-secondary educational system into one that was "learner-centered, collaborative, accessible, innovate, [and] responsive" (Alberta Learning, 2002, p. 3).

With this initiating document being a preamble to the concept of Campus Alberta, parameters were set forth around the emerging notion of lifelong learning for Albertans. Through defining and delineating the advanced learning system by means of a guiding set of principles, the document proposed tentative mandates for various learning institutes across the province in order that they might work together seamlessly and in the spirit of collaboration to provide opportunities to Albertans for acquiring learning. This document

paved the path for subsequent evolutionary development in the framing of Campus Alberta several years later.

To further enhance the understanding of advanced learning system of Alberta, and encourage further refinement of the concept of Campus Alberta, three thousand Albertans' suggestions, inputs and ideas were taken regarding the advanced learning system between the years 2005-2006. This review was rolled into a final report and named 'A Learning Alberta' (A Learning Alberta Steering Committee, 2006).

The report suggested a strategic plan for transforming the advanced learning system; the focus was on improving access, and success, of Albertans in the advanced educational system of Alberta. Consequently, by providing opportunities for all Albertans it could be expected that Alberta would become a province that is a learner-centered, having vibrant learning communities, recognized as a global leader in generating new knowledge, and that such new knowledge would lead to innovative ideas to improve the economic, social, and political well-being of the society.

In response to the recommendations from the 'A learning Alberta' report, the 'Roles and Mandates Policy Framework' document was formulated (Alberta Advanced Education and Technology, 2007). The principles of the framework provided by the document were legislated with the passing of the Post-secondary Learning Act (PSLA). In order to ensure that the system was aligned with the needs of the learners, economy, and society, the framework dictated roles and mandates for all publically-funded post-secondary institutions throughout the province with the implementation of a six sector model. This model is based on institutional differentiation that is determined from the programs offered, providing degree based on the intensity of research activity, client based and geographic

focus. The model is broken into the following six sectors: Comprehensive Academic and Research Institutions (CARI), Baccalaureate and Applied Studies Institutions (BASI), Polytechnical Institutions (PI), Comprehensive Community Institutions (CCI), Independent Academic Institutions (IAI), and Specialized Arts and Culture Institutions (SACI).

Institutions in CARI sector can provide programs that lead to the granting of undergraduate, graduate and doctoral degrees, have comprehensive research function in which they can do pure, applied, and scholarly research (Province of Alberta, 2003). The following Universities are considered as CARI: Athabasca University, University of Alberta, University of Calgary and University of Lethbridge (Alberta Advanced Education and Technology, 2007).

Institutions in BAI sector can provide programs that lead to diplomas, certificates, applied degree and undergraduate degree, university transfer programs, have applied research, or scholarly research that is related to approved program of undergraduate degree (Province of Alberta, 2003). The two institutes are Grant MacEwan College and Mount Royal College (Alberta Advanced Education and Technology, 2007).

Institutions in PI sector provide programs and courses that lead to diplomas, certificates, applied degrees and undergraduate degrees, conduct applied research, or scholarly research that is related to approve program of undergraduate degree (Province of Alberta, 2003). The two institutes in this sector are NAIT and SAIT (Alberta Advanced Education and Technology, 2007).

Institutions in CCI sector provide programs that lead to the granting of diplomas, certificates, and applied degrees. They can grant an undergraduate degree if the Minister

approves, or the program is provided in collaboration with another institution that has been given the permission by the Government to grant the undergraduate degree. They are eligible to conduct applied research, or scholarly research that is related to the approved program of study (Province of Alberta, 2003). The eleven institutes in this sector are: Bow Valley College, Grande Prairie Regional College, Keyano College, Lakeland College, Lethbridge College, Medicine Hat College, NorQuest College, Northern Lakes College, Olds College, Portage College, and Red Deer College (Alberta Advanced Education and Technology, 2007).

Institutions in IAI sector can grant undergraduate, graduate and doctoral degrees, and do applied/scholarly research related to the approved program of study for the granting of the undergraduate/graduate/doctoral degrees (Province of Alberta, 2003). The three institutes in this sector are: Ambrose & St. Mary's University Colleges, Canadian University College, and Concordia, King's, & Taylor University Colleges (Alberta Advanced Education and Technology, 2007).

Institutions in SACI sector can grant diplomas, certificates, undergraduate, graduate and doctoral degrees, and do applied and scholarly research related to the approved program of study (Province of Alberta, 2003). The two institutes in this sector are Alberta College of Art & Design and Banff Centre (Alberta Advanced Education and Technology, 2007).

Through the definition of six sector model, the framework is seen to provide a strong foundation to achieve the vision of Campus Alberta and develop Alberta's advanced learning system to be collaborative, efficient and resilient.

With the recognition by the government of Alberta that for the province to maintain competitive advantage in a globalized economy, creation and spread of knowledge is needed; the government of Alberta acknowledged their commitment with Albertans to provide opportunity for enhancing their social, cultural and economic well-being by having an advanced learning system in place that is responsive, flexible and accessible. As a result, learning opportunities for Albertans were to be ensured by having a collaborative and amalgamated system approach consistent with the 2002 intent of Campus Alberta.

With the 'Post-secondary Learning Act' (PSLA) coming into force in 2004, greater focus was given to advance the framework of Campus Alberta so that Alberta's advanced learning system for Albertans would become a system that was flexible, responsive and accessible. Moreover, the PSLA established the Campus Alberta Quality Council (CAQC) and set out conditions and rules for establishing and managing institution-related matters. In addition, the six sector model of the post-secondary institutes in Alberta was recognized and enshrined in the PSLA (Province of Alberta, 2003).

In order to ensure the continuous evolution of the concept of Campus Alberta, a document entitled 'Campus Alberta Interim Strategic Plan' was recently drafted presenting short-term strategic plans and a proposed process to develop a more formal plan that took into consideration collaborative actions over the years in shaping the advanced learning system. This latest initiative is being undertaken in order to ensure that the advanced learning system remains a successful system for Albertans (Alberta Government, 2014).

Set in the above-mentioned background context, the way for moving forward was presented by having new outcomes for the system that reflected the dynamics of the system and allowed for realizing the full potential of Campus Alberta to be a game changer for

Albertans. As such, the three outcomes that the document put forward were: "Learner-Enabled System, Value for Investment, [and] Advancing Knowledge" (Alberta Government, 2014, p. 3). In addition, the document provided strategic priorities for each of the three system-level outcomes.

The document explained that a Learner-Enabled System outcome would remove the barriers that presently exist between learners and learning providers, respect choices of learners and allow for learners to become empowered. The Value for Investment outcome would ensure that the advanced learning system maximizes the benefits through resources that are invested; and the Advancing Knowledge outcome would ensure that the advanced learning system can play a prominent role in ensuring that Alberta is progressing adequately as a knowledge-based economy province and that societal and economic objectives of the province are met.

4.1.2 Comprehensive Strategy of Campus Alberta: Organizational Learning about Campus Alberta's Distinctive Competencies

From a conceptual perspective, Campus Alberta has the potential to expand and extend opportunities for Albertans by developing and enriching their capabilities through a setup of clearly mandated advanced education system. Such a positive prospect is expected to transpire through a collaborative contextual structure in which the application of expansion and extension of opportunities are linked to the social, cultural, and economic well-being of Albertans. Consequently, this comes about when stakeholders of Campus Alberta examine their ecosystem from a holistic way of thinking: recognizing that positive outcomes are derived when present players in the system work together (Alberta Learning, 2002).

Accordingly, all advanced learning providers have an important task in ensuring that the competencies of the advanced learning system will result in accomplishing the intended ultimate outcomes of Campus Alberta.

These can be achieved by realizing that Campus Alberta can be a collaborative system. With the stakeholders of the system working together, Albertans can achieve their learning objectives. Additionally, meeting the objectives of Albertans can be ensured when the system has seamless transitions. This means that the framework of Campus Alberta provides multiple range of learning pathways. In addition, the system needs to enable learners to have greater movement in acquiring learning and ensure that resources are used in a sustained and effective manner. This will then result in having a system that has the capability to be responsive to challenges and opportunities and provide a higher quality of education that is recognized globally (Alberta Advanced Education and Technology, 2007).

Moreover, such an impact will improve the socio-economic conditions of such segments of the society that have historically been considered as underprivileged and have not been represented sufficiently. The province's First Nations, Metis and Inuit (FNMI) citizens are of particular interest in this regard. This would allow for a larger segment of Alberta's society to be in a position to adapt to changing environment and be productive members of the community (Alberta Advanced Education and Technology, 2007).

Additionally, the adoption of Campus Alberta is expected to transform the economy of the province to a knowledge-based economy. This will ensure a closure between the gaps that currently exist between potential/existing workforces and actual employment

specifications/requirements. Moreover, this will encourage the promotion of democratic political values among Albertans (Alberta Advanced Education and Technology, 2007).

4.1.3 Comprehensive Strategy of Campus Alberta: Product-Market Domain

Alberta has the potential to become a leading role-model for other provinces of Canada. There is a recognition that an advanced learning system is an investment for ensuring that the social well-being and economic prosperity of the province are maintained. Moreover, with a well-designed learning system in place, this will have the potential for Alberta to produce world-class research and become one of the leading places for innovation and research in the world.

For the advanced learning system to function properly in a knowledge-based economy, it is important that the contextual setting for its research systems be able to match international standards. Moreover, such research systems need to be affordable for Albertans along with a greater understanding by the stakeholders of Campus Alberta that tangible benefits can be derived from the acquisition of learning. This will result in having: a rate of participation in education that is comparable with the highest in the G8 countries, the highest participation rate in post-secondary institutions among other Canada's provinces, the best supporting programs for Alberta learners and, nationally, post-secondary institutions will be considered as premier institutes (A Learning Alberta Steering Committee, 2006).

This will, also, result in ensuring that the current and anticipated labor requirements in Alberta are met, transforming Alberta as a province that has enhanced entrepreneurial capacity, and greater recognition and acknowledgement in the communities across Alberta

to be socially-responsible and democratic, along with ensuring that Alberta retains its competitive edge (Advisory Team, 2014).

4.1.4 Comprehensive Strategy of Campus Alberta: Core Values

The values for which Campus Alberta stands are connected with the recognition that Alberta's progress in social, cultural, and economic well-being is shaped through an advanced education system that is: adaptive to changing forces, embraces diversity, high-quality, accessible, and focused on meeting the needs of the Albertan learners (Alberta Advanced Education and Technology, 2007). Accordingly, such a learning system would be able to support the inspiration of the participants by providing quality and innovative learning opportunities through collaboration and that which is responsive to the needs of the learners in the advanced learning system (Advisory Team, 2014; Alberta Government, 2014). In addition, multiple ranges of pathways for acquiring learning are recognized so that learners' transition is feasible, and their movement between institutions is feasible. In addition, learning is not only recognized by a formal learning feedback but also through informal learning. As such, this would allow the learners in the system the flexibility to opt for their paths for acquiring knowledge that may be outside the formal educational system (Alberta Advanced Education and Technology, 2007).

Moreover, the learning system needs to embrace ethical leadership, which means that governance practices should be sound and ethical for learning providers and learners. Also, the practices in the advanced learning system are to be transparent and communication open. It is also important that there be environmental awareness, which means that there is a recognition of the value of sustaining an eco-friendly environment. Finally, of course, resources are to be used efficiently. (A Learning Alberta Steering

Committee, 2006; Alberta Advanced Education and Technology, 2007; Alberta Learning, 2002).

4.1.5 Comprehensive Strategy of Campus Alberta: Objectives

The aim of the advanced learning system is to enhance Alberta's social, cultural and economic well-being through a learning system that is globally-recognized, high-quality, responsive to provincial needs and requirements, adaptive to sudden dynamic changes and forces, and unleashes innovation (Alberta Advanced Education and Technology, 2007; Alberta Government, 2014). With the agreement of the stakeholders, accordingly, in the evolved Campus Alberta framework there are three ultimate outcomes that identify the aim of the Campus Alberta: Enhanced Human and Intellectual Capital, Enhanced Economic Capital, and Enhanced Social and Cultural Capital (Alberta Government, 2014; Advisory Team, 2014).

Attaining these three ultimate outcomes are contingent on achieving the three priority system-level outcomes in the framework of Campus Alberta, which are associated with strategic priorities of the advanced learning system. They are Learner-Enabled System, Value for Investment and Advancing Knowledge (Advisory Team, 2014).

The Learner-Enabled System outcome refers to the province's advanced learning system being able to empower, facilitate and support learners by recognizing, understanding, respecting and addressing their aspirations and desires of learning choices. Consequently, the advanced learning system of Alberta reduces the barriers for individuals to access the system and provide opportunities to the learners (Alberta Government, 2014; Advisory Team, 2014).

The Value for Investment outcome refers to the advanced learning system being able to maximize gains, advances and benefits with the amount of resources invested. Additionally, there is greater emphasis placed on recognizing the fact that to maintain high-quality education there is a price to be associated. Such a system will be able to produce results that are tangible and quantifiable through effectively and efficiently utilizing resources (Alberta Government, 2014; Advisory Team, 2014).

The Advancing Knowledge outcome calls for the advanced learning system of Alberta to enhance the intellectual fabric and knowledge economy of the province through the recognition of the important role played by institutions in accomplishing societal and economic objectives; and not just by putting emphasis on the formal instructional mandate/role of the advanced learning system (Alberta Government, 2014; Advisory Team, 2014).

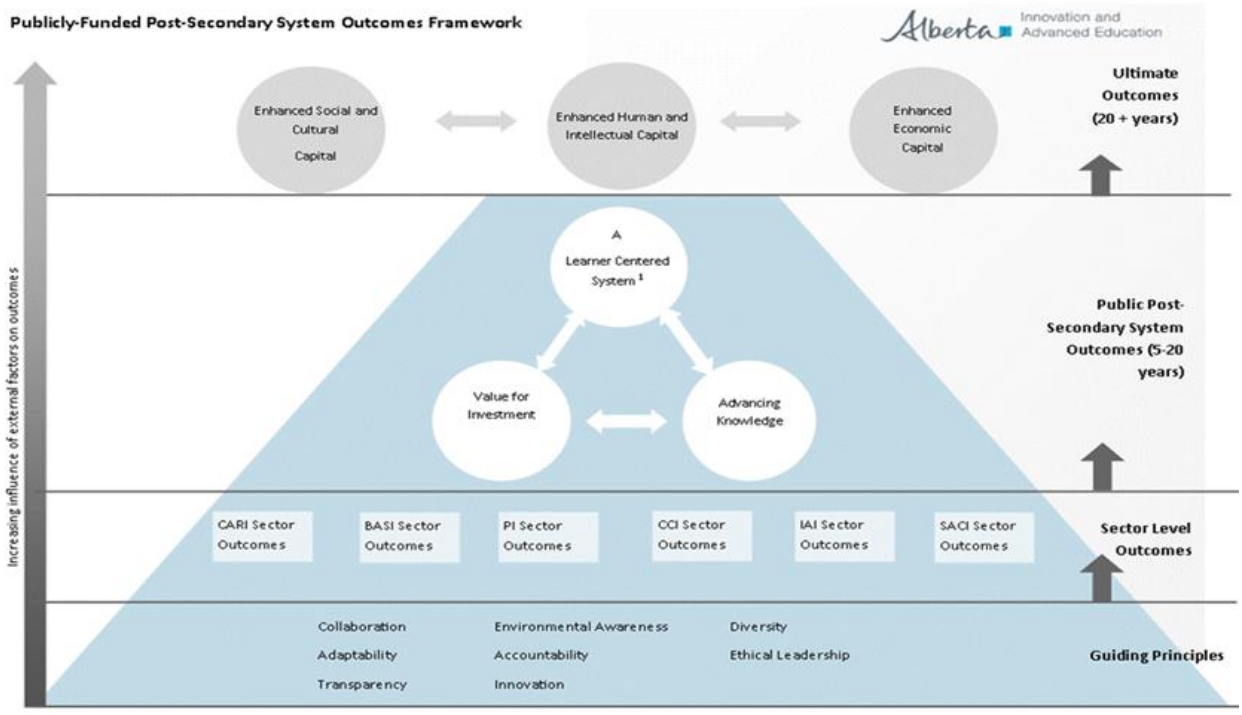

Figure 4. System Outcome Framework. Source*:* Taken from Advisory Group, 2014, Alberta Public Post-Secondary System Outcomes Framework Overview.

4.2 Burgelman's Model: Induced Strategy Process

The strong induced strategic feedback process/loop of an organization's comprehensive strategy affects and directs the formulation, planning and implementation of the strategy at the operational level and meso level of the system. This resembles the conventional processing that transpires in a generic organization that is directed by top-driven task-oriented management. The lower half of Burgelman's Model indicates the dynamism that ensures that the strategic proposal generating process is in line with the current comprehensive strategy of the organization. As such, by being the guiding force that has a strong influence at the level of the induced strategic action, the process/loop ensures that any strategic formulation that transpires in the induced strategic action is oriented towards maintaining the concept of the comprehensive strategy of the organization. The resulting influence from induced strategic behavior does not have a strong force to amend the comprehensive strategy of the organization due to the intervening influence of the structural context determination of the organization. Accordingly, through intervention, the context ensures that any strategic proposal selected in the induced strategic process does not lead to a dramatic increase in the variation of the organization's products or routines. The emphasis in on 'business as usual' and any changes tend to be incremental only (Burgelman, 1983, 2002).

4.2.1 Induced Strategic Behavior in the Induced Strategy Process/Loop of Campus Alberta

Strategic actions that originate at the level of induced strategic process of the system will be shaped and fitted with Campus Alberta's "concept of corporate strategy and leverage the organizational learning that it embodies" (Burgelman, 2002, p. 11). This

ensures that the comprehensive strategy of Campus Alberta remains in a state in which it was conceived and shaped by ministerial policy. Therefore, a high form of congruence exists between the strategic actions at the level of induced strategic action and the core strategy of the system. Moreover, induced strategic behavior does not generate a high level of equivocality in the system since it seeks opportunities in the established categories that are formulated in the concepts of the comprehensive strategy of the system. Accordingly, new developments in this level can be judged in the light of the present performance measurement tools of the system.

The generic frame of reference in Burgelman's Model as to what constitutes an induced strategic behavior guided me when looking at the documents that are related to Campus Alberta. Since the *a priori* theory is Burgelman's Model, and hypothetical induction is the process of connecting data to the *a priori* theory, this means that I needed to look into documents that were related to the induced strategic behaviors of Campus Alberta. Therefore, I have studied, and then interpreted, documents that are available on the web link of Campus Alberta and are linked with apparent induced strategic behaviors driven by Campus Alberta policy. As a result, the following documents were studied to provide a better understanding of induced strategic behaviors with Campus Alberta: (1) Access to Future Collaborations (Alberta Innovation and Advanced Education), and (2) CIP (Comprehensive Institution Plan). For the second type of document, the University of Lethbridge's CIP and institution-level documents; such as capital plan and annual report, are used to illustrate the standard plan/formulation that all post-secondary institutions file with the Government to provide a three year window into the minor incremental changes

that fit within the framework of Campus Alberta (University of Lethbridge, 2014a, 2014b, 2014c).

4.2.2. Induced Strategic Behavior of Campus Alberta: Access to Future Collaboration

The intent of the 'Access to the Future Collaboration' program is to ensure that support is being provided to enhance excellence and greater innovation in the post-secondary learning system of Alberta province through collaborative projects between and amongst individual institutions. As such, this will provide "accessible, affordable and high quality learning opportunities for Albertans" (Alberta Innovation and Advanced Education). Established in 2005, through the passing of Access to the Future Act, the targeted endowment, with full implementation, was expected to be funded at $3 billion – but that is unlikely given the current fiscal realities.

Funds are allocated to those providers of adult learning who can respond effectively to the societal needs and individuals needs in the learning system through the counsel and recommendations that come from the Access Advisory Council.

The Annual Report by the Access Advisory Council's Chair is presented to the Minster of Advanced Education and Technology, and which summarizes the council's activities during the operational years. Appointed in 2006, the Access Advisory Council is tasked with providing strategic advice to the Minister of Advanced Education and Technology regarding the Funds' operational modus, objectives, and evaluation and accountability process. Through getting feedback from the stakeholders of Campus Alberta, the Council produces a series of recommendations to the Minister for the future steps needed to be taken for the Access to the Future Fund. For instance, $42.6 million was

given to the Alberta advanced learning system in 2008-2009 with a breakdown between the six sectors; as mentioned in the report, through the Renaissance funding program. Also, the report notes that funds were provided as project-based funding to initiatives selected through a competitive application process, in which 8 were endorsed for the recommended grant. A partial illustration of the intent of this Fund, its participants and funding levels is provided below (Access Advisory Council, 2009):

Alberta Nonprofit/Voluntary Sector Community Capacity Innovation Project
Community Learning Network, Literacy Alberta, Volunteer Alberta
$2,000,000

Best Practices for Attracting and Retaining Learners from Underrepresented Populations
Alberta-North (Athabasca University, Grande Prairie Regional College, Keyano College, NAIT, Northern Lakes College, Portage College)
$327,000

Childcare Training for Low Literacy Immigrant Women
Bow Valley College, Calgary Immigrant Women's Association, Calgary Catholic Immigration Society and other community partners
$232,690

Clinical Skills Development Model and Technology Framework
Olds College, NorQuest College, Bell e-Learning Centre
$181,000

Curriculum Commons Model for Post-Secondary Institutions
Keyano College, Lakeland College, NorQuest College
$241,000

Enhancing Collaboration and Improving the Learning Environment – Utilization of Advanced Microscopy Equipment in Undergraduate Science Courses
University of Alberta, University of Calgary, University of Lethbridge
$1,660,242

Within the Access to Future Fund, there are two divisions of the funding program: Innovation Fund and Renaissance Fund. The Innovation Fund program provides funds for such programs that can enhance creativity, innovation and novelty practices among the providers in the advanced learning system, stimulate and spread collaboration initiatives in

the advanced learning system, and increase the rate of participation among Albertans in the advanced learning system. Projects that require this fund have to go through a competitive application-based process; which is reviewed by the Access Advisory Council, who then make the recommendation to the Minister for the project to be funded (Alberta Innovation and Advanced Education; Access Advisory Council, 2009).

In the case of Renaissance Fund, the aim is to stimulate donations to the advanced learning system by providing grants that match with the philanthropic donations provided to the advanced learning system. Accordingly, the objective is to match donations to institutions that can support/enhance quality learning, accessibility, and affordability. For 2014-2015, approximately $50 million of funding through the Renaissance funding program was expected to be provided to Alberta's advanced learning system. (Alberta Innovation and Advanced Education; Access Advisory Council, 2009).

The direction that the Access Advisory Council takes for funding allocation through Innovation Fund and Renaissance Fund programs comes through the development of the "Ministry's Roles and Mandates Policy Framework for Alberta's Publicly Funded Advanced Education System and the Alberta Access Planning Framework" (Access Advisory Council, 2009). Accordingly, the comprehensive strategy of Campus Alberta guides and informs the Council on developing a series of recommendation to be given to the Minister. As such, in the spirit of Campus Alberta, the Council works in such a manner that the continuously evolving requirements of the advanced learning system are met and it can demonstrate the promotion of the principles of Campus Alberta (Access Advisory Council, 2009).

4.2.3 Induced Strategic Action of Campus Alberta: Comprehensive Institutional Plan

The mandate of a post-secondary institution in Alberta is granted through the authority of the *Post-secondary Learning Act* of Alberta. As noted earlier, there are a total of 26 Post-secondary institutions in Alberta that are segmented into a six sector model: Comprehensive Academic and Research Institution (CARI), Baccalaureate and Applied Institution (BAI), Polytechnical Institution (PI), Comprehensive Community Institution (CCI), Independent Academic Institution (IAI), and Specialized Arts and Culture Institution (SACI).

The PSLA states that each institute in the advanced learning system needs to design a statement that sets out the institute's mandate in the form that is established by the Minister. It is the prerogative of the Minister to decide which institute is to be placed in what sector. In order for the mandate of the institute to be approved by the Minister, there must be an alignment and consistency between the institute's mandate and the role expected of institutions in the particular sector. The resourcing of institutes is thereby grounded in sectoral roles and mandates as allocated by a system level.

For instance, in the case of the University of Lethbridge, the University is defined as a Comprehensive Academic and Research Institution. Accordingly, under the principles of the framework of Campus Alberta, and enacted through the passing of PSLA, the University of Lethbridge is committed to ensure that its Mandate Statement meets the requirements and criteria that are expected from an institute in the CARI sector.

Being founded on the principles of liberal education, the University of Lethbridge grants undergraduate/master/ and doctoral degrees in various disciplines – ranging from

sciences to social sciences. Moreover, it also provides degrees and certifications that lead to professional specialization for the learners. The quality of the academic programs is developed and maintained to serve the needs and requirements of the society. Moreover, the institution strives to ensure that learners in the advanced learning system have seamless learning opportunities. This is done by maintaining collaborations with other institutions in Campus Alberta which in turn affirms the framework of Campus Alberta. Moreover, through collaboration with other institutes there is enhanced transferability and movement for the learners in the advanced learning system (University of Lethbridge, 2014c).

To enhance the improvement of society, University of Lethbridge takes an active interest in advancing knowledge through activities of pure and applied research and ensures that the sustainability of the institution is maintained. Through pursuing research, the University of Lethbridge is able to develop and create new ideas/novelty within the existing academic programs/disciplines that leads to meeting the needs of economy and societal issues of Alberta (University of Lethbridge, 2014a, 2014c).

By embracing the role of being one of the four comprehensive academic and research institutions (CARI) in Campus Alberta, the University of Lethbridge has acknowledged the characterization of the classification for this particular sector in the framework of Campus Alberta. Accordingly, they are providing opportunities for studying "at all levels… and across the full breadth of disciplines" (University of Lethbridge, 2014c, p. 2). There is a continuous search to identify new programs within their mandate that will serve Albertans and which can provide various routes for attaining learning in different regions of the province for Albertans. As such, new programs are designed to encourage critical thinking, develop entrepreneurship and citizenry in the learners, and meet the

demands of the learners, labor markets, and societal values. Moreover, such programs encourage greater participation from the traditionally underrepresented segments of society. The result is an organization that develops and sustains a learning community that values innovations (University of Lethbridge, 2014a).

The University of Lethbridge strives to tie their directions and key initiatives to the government through a Capital Plan. The aim of the University of Lethbridge is to align its processes, strategies and objectives with key strategic documents and goals of the government. As a result, there is an attempt by the University of Lethbridge to meet the expectations of key objectives; such as, ensuring that there are greater development and enhancement of technology programs to match the required demand for increased rates of students and employers, addressing challenges in workforce, responding to challenges of economic growth, and that there is greater fostering of economic diversity (University of Lethbridge, 2014b).

In addition, the principles of the University of Lethbridge's are aligned with the principles of Campus Alberta. For instance, focus is on cultivating responsible citizenry in Albertans, encouraging freedom of expression, linking with the greater segment of the society, adoption of global outlook that encourages promotion of equal opportunity and diversity among participants in the post-secondary system, working for the greater good of the public, and that research and creative processes are environmentally sound and socially acceptable (University of Lethbridge, 2014a, 2014b, 2014c). The key role of the CIP and related documents is thus very consistent with the induced process described in Burgelman's Model.

4.2.4 Burgelman Model: Structural Context Determination

This is an encompassing concept used to signify the varying mechanisms that are used in the system for managing the induced strategic behaviors generated within the system so as to keep them in line with the current comprehensive strategy. As such, there is a strong signal from the comprehensive strategy of the system to the structural context determination component of the system. This defines the choices that the system decides regarding the type of criteria needed to screen new strategic initiatives, and evaluation and measurement standards for performance of the strategic initiative in order to match the strategic initiatives with the comprehensive strategy of the system (Burgelman, 1983; 2002). Subsequently, in this context, there is a congruence between the existing strategic design of the induced strategic action level with the corporate strategy through "administrative and cultural mechanisms" (Burgelman, 2002, p. 12). Given this linkage of the current comprehensive strategy to the structural context, the feedback signal (dotted line) is essentially an echo of the existing strategy and presents only a weak possibility of significant change.

4.2.5 Structural Context Determination of Campus Alberta

The influence of Campus Alberta is felt by 26 institutions spread across six different institutional sectors, but the administrative structure remains significantly decentralized. Since 2008, the Board of Governors Chair from each of the institutions has met several times a year jointly at sessions chaired by the Minster of Innovation and Advanced Education. The Presidents of the 26 institutions typically also attend this group that is called the Campus Alberta Strategic Directions Committee. The connecting context ensures that there is coherence/congruence between the operational activities of the institutions; thus, meso-level committee of the system and the comprehensive strategy of Campus Alberta

may be seen in the structural context determination. Through this context, the system is able to maintain congruence between the existing strategic design of the induced strategic action level with the comprehensive strategy of Campus Alberta through "administrative and cultural mechanisms" (Burgelman, 2002, p. 12). Accordingly, the structural context of Campus Alberta will encompass administrative arrangements, e.g. planning and control systems; and cultural aspects, e.g. principles of socialization processes.

The generic frame of reference in Burgelman's Model as to what constitutes a structural context determination guided me when looking at the documents that are related to Campus Alberta. Since the *a priori* theory is Burgelman's Model, and the hypothetical induction is the process of connecting data to the *a priori* theory, this meant that I needed to look into documents that were related to the structural context determination of Campus Alberta. Therefore, I have studied, and then interpreted, those documents that are written with a perspective that relates to the evaluation and control of induced strategic behaviors by the agents acting within Campus Alberta. As a result, the following documents were studied: (1) CAQC (Campus Alberta Quality Council, 2013), and (2) Results-based budgeting framework that includes the strategic priorities in Campus Alberta (Advisory Team, 2014).

4.2.6 Structural Context Determination of Campus Alberta: Campus Alberta Quality Council

The PSLA has established Campus Alberta Quality Council (CAQC) as a central quality assurance agency for the degree and program approval process. When applications arrive from the post-secondary institutions seeking to offer new degree programs in the province, it is the CAQC that makes a series of review, evaluation and recommendation

steps for all such applications to the Minister of Innovation and Advanced Education, under the terms of PSLA and Programs of Study Regulation (91/2009). This also includes programs of study proposed by institutions external to the province in either classroom or virtual formats (Campus Alberta Quality Council, 2013).

In order to ensure that a high standard of quality is maintained by the approved degree programs, periodic evaluations by the CAQC are conducted on the post-secondary institutes' approved degree programs so that the advanced learning system's degrees are recognized nationally and internationally. As a result, the activities of CAQC are appropriately standardized to be comparable with national and international standards (Campus Alberta Quality Council, 2013).

Given that the membership of CAQC is composed of senior academics from inside and outside Campus Alberta institutions, the activities of CAQC are peer evaluated and include perspectives from stakeholders so that the best interests of learners and respect to role of academic freedom in the Campus Alberta are kept during the process of reviewing application for the new program. Members serve three-year terms on the Council (Campus Alberta Quality Council, 2013).

The autonomous nature of CAQC is retained in order to ensure that trust remains in its processing of the application by the post-secondary institutions; with the standard operations being impartial for all institutions in Campus Alberta. Added to it are transparency and openness in the operations of CAQC, the plausibility of iterative in the process for accrediting programs by the CAQC, and focus towards reviewing its own activities so that the axioms of natural justice are maintained. Aligning to the comprehensive strategy of Campus Alberta, it promotes institutional diversity, monitors

approved programs and decisions to ensure that ethical standards are followed by members and peer reviewers of the CAQC, and recognises that maintaining and enhancing academic and institutional quality of an institution is the primary responsibility of the institution itself (Campus Alberta Quality Council, 2013).

4.2.7 Structural Context Determination of Campus Alberta: Results Based Budgeting Framework of Strategic Priorities

The process of results-based budgeting (RBB) related to Campus Alberta is concerned with outcomes. The strategy is to ensure that there is alignment of governmental programs and services with the outcomes that Albertans have identified and classified as being strategic priorities in an effective and efficient manner (Government of Alberta, 2012).

Launched in the spring of 2012, the RBB implementation involved members from the society and members of the government to review all government-affiliated programs and services. The review has been organized into three cycles with the reviewing of programs and services being done by front line workers, while those in the challenge panels providing oversight are members of the public and government members who ensure that recommendations that emerge are in line with the aspirations of Albertans. When the advanced education sector was reviewed in the third cycle there was an acknowledgment by the government that the RBB process would be considered as a leverage mechanism by which an evaluative strategy might be designed to provide a better understanding of the dynamics of the advanced educational system, along with allowing behavioral modifications to emerge in the system in order to achieve designated outcomes of the system (Advisory Team, 2014).

Since September 2013, there have been multiple stakeholders of Campus Alberta involved in designing an evaluation process for the post-secondary educational system. Such an evaluative process is designed to meet the mandate of the *Results-Based Act (2012)*. Accordingly, instructions were given to the Advisory Team of the advanced learning system to develop an indicator framework in order to monitor behavioral modifications in the system (Advisory Team, 2014).

Consequently, there was an agreement in the first Advisory Team meeting that there was a need to develop a working group that had the necessary competencies and capabilities to design an indicator framework to complement the comprehensive strategy of Campus Alberta (Advisory Team, 2014).

Accordingly, the government and stakeholder groups came together on March 4, 2014 and agreed that for attaining the comprehensive strategy of Campus Alberta it was important to have an evaluating process that was designed while being in alignment to identify system level outcomes; which in turn would lead to ultimate outcomes. As such, an evolved framework emerged that recognized that existing metrics for a number of strategic priorities might serve as a dashboard from which it would be possible to monitor the system. However, it was also clear that the ability to assess whether behavioral modifications in the system were supportive or antagonistic to achieving the system level outcomes were less well developed. In particular, one of the strategic priorities underpinning the Value for Investment outcome - System Sustainability - did not have any existing measures identified and it was agreed that measurement for this strategic priority would be deferred until the next RBB cycle (Advisory Team, 2014).

It needs to be noted that while the three system outcomes may seem to be distinctively apart from each other, there is a complex relationship that exists amongst them. They are interdependent, and one outcome cannot be attained in isolation from the other outcomes. Attaining these outcomes can only come about by creating a congruence between the three outcomes (Advisory Team, 2014).

Classifying the System Sustainability as a strategic priority under the Value for Investment outcome, the document defines it as contributing to a "healthy and vibrant system that is resilient, adaptable, and diverse" (Advisory Team, 2014, p. 14). The rationale for putting this as a strategic priority under the particular system outcome is because "placing a strategic focus on system health is central for maintaining that the system is able to pursue long-term success" (Advisory Team, 2014, p. 14). As mentioned previously, no present indicators have been formulated for this strategic priority.

However, in light of Burgelman's Model, we can notice that a better alignment for this strategic priority would be in the strategic context determination of Campus, rather than the structural context determination of Campus Alberta. I will explain this reasoning when I come to the topic of strategic context determination of Campus Alberta under section 4.3.11 of the thesis.

4.3 Burgelman's Model: Autonomous Strategy Process

In comparison to the induced strategic process, the autonomous strategic process is less understood and is the upper processing loop in the Burgelman Model. The principal difference between the two types of strategic processing is that the induced strategic process leads to variation reduction and stability in the organization and its environment, while the autonomous strategic process supports variation and potential disruption by

drawing on influences from the organizational environment. Through autonomous strategic behavior, there is an emerging possibility of revising the comprehensive strategy of the organization as indicated by the solid lines linking autonomous behaviors, strategic context and strategy in the model. This happens through the mediation of the strategic context determination (Burgelman, 1983, 2002).

4.3.1 Autonomous Strategic Behavior in the Autonomous Strategy Process/Loop of Campus Alberta

Autonomous behavior actions are strategic actions taken by individuals or small groups that differ from the induced targeted strategic actions made by the organization. Such actions are emergent in nature and have the potential to be disruptive to the normative organizational processes. Consequently, when such activities emerge they are not within the "scope of the corporate strategy at the time that they come about" (Burgelman, 2002, p. 13). Such forms of new autonomous strategic actions tend to involve new conglomeration of existing competencies that had not been previously recognized as "distinctive or centrally important to the firm" (Burgelman, 2002, p. 13). Though such strategic actions may be difficult to predict, nevertheless they are "constrained by the company's set of distinctive competencies at any given time" (Burgelman, 2002, p. 13). In a business context, such actions might include suggested product ideas by customers or ideas brought back from conferences attended by R&D scientists.

The generic frame of reference in Burgelman's Model as to what constitutes an autonomous strategic behavior guided me when looking at the documents that are connected with the framework of Campus Alberta. Since the *a priori* theory is Burgelman's Model, and the hypothetical induction is the process of connecting data to the *a priori*

theory, this meant that I needed to look into documents that were related to the autonomous strategic behavior dimension of the framework of Campus Alberta. As such, they needed to be documents that were designed/reported by non-governmental teams/groups and yet bore some relevance to the framework of Campus Alberta. This linkage corresponds in the model to the dotted lines that lead from the structural context to the strategic context and back to condition which new-order creations are brought forward. They are relevant yet may be only loosely tied to current strategy.

Accordingly, I typed the keyword 'Campus Alberta' in the Google search engine and looked for new categories that have been/are being developed by non-governmental teams/stakeholders, but which represent inter-institutional order consistent with Campus Alberta goals. Consequently, the following documents that I have found are those representing autonomous strategic behaviors that are transpiring within the general framework of Campus Alberta. These documents that I have studied, and then interpreted, are linked to the notion of autonomous strategic behavior being connected with the framework of Campus Alberta. They are: (1) Campus Alberta Neuroscience ("Campus Alberta Neuroscience,"), (2) Campus Alberta Student Conference of Health ("Campus Alberta Student Conference of Health,"), (3) Campus Alberta Health Outcomes & Public Health ("Campus Alberta Health Outcomes & Public Health,") and (4) Campus Alberta Central ("Campus Alberta Central,").

4.3.2 Autonomous Strategic Behavior within Campus Alberta: Campus Alberta Neuroscience

Each of the CARI Universities (University of Alberta, University of Calgary, and University of Lethbridge), with the exception of Athabasca University, has a centre for the

study of Neuroscience. However, all the three institutes agreed that though they have some of the best researchers in their centres, a single institute alone cannot be expected to tackle research related to brain diseases and mental health ("Campus Alberta Neuroscience,").

They came to the realization that having a network that is province-wide and researchers from all the three universities coming together on a single platform (which number approximately 250 researchers) would allow the possibility to accomplish extraordinary achievements ("Campus Alberta Neuroscience,").

As such, Campus Alberta Neuroscience was launched in 2009 and became a connector in bringing applied researchers, basic scientists, and practical clinicians together. The intended target is to deliver, actual, meaningful, quantifiable and long term, results in advancing solutions to mental and neurological illnesses by ensuring aggregation and production of knowledge is transferable easily among the research professionals. Supplementary to this would be transforming the province as being recognized, internationally, as the best destination for brain researchers and the region where the highest quality of collaboration among research scientists takes place ("Campus Alberta Neuroscience,").

In addition to the production of pure knowledge, there is the potential to translate pure scientific knowledge into new medical-related products. As such, this can profit the medical/hospital industry and social industry**,** and also create an awareness in Albertans of the link that exists amongst quality and standard of living/happiness/aging with dignity with brain science ("Campus Alberta Neuroscience,").

The focus is to ensure that new collaborations are facilitated. As such, there are Team Formation Program, Academic Exchange (CANAE) Program, Trainee Mobility

Program, and International Scholars (CANIS) Program. These four programs build bridges, cooperation and collaboration amongst the neuroscience community of Alberta, and between the neuroscience community of Alberta with prominent international mental health and neuroscience researchers ("Campus Alberta Neuroscience,").

In addition, there is the desire to have a network among the members of the neuroscience community and stakeholders. As such, this can help in accelerating the development of new medical technologies that can improve the quality/standard of living for Albertans and simultaneously improve the economy of organizations in the medical/hospital industry and social industry; which in turn, can enhance the economy of the province ("Campus Alberta Neuroscience,").

Finally, and most potentially disruptive to the current system, Campus Alberta Neuroscience has piloted joint course instruction across the three participating institutions. This initiative raises several issues with respect to course ownership, tuition, delivery format and faculty classroom/curriculum coordination. The system level potential to trigger rationalization of instructional resources across institutions is particularly significant.

4.3.3 Autonomous Strategic Behavior within Campus Alberta: Campus Alberta Student Conference on Health (CASCH)

Initiated in the summer of 2012, through a Conference Grant awarded by Alberta Innovates – Health Solutions, free conferences are organized by provincial students for provincial students that have the full backing, support and collaboration from the University of Alberta, the University of Calgary, and the University of Lethbridge. The idea is to bring hundreds of Albertan students that are studying global health, health

sciences, and public health together so that there is enhanced professional development, possibility of networking and dissemination of knowledge among the future shapers of Alberta ("Campus Alberta Student Conference of Health,").

It is a platform where students, studying for undergraduate/graduate degrees, across Alberta are able to meet and discuss contemporary topics, issues, trends and future directions that are/can transpire in health industry, healthcare, health practices and health research in the province. Through a process of multi/cross – disciplinary dialog, individuals in the conference are in a position to create potential collaboration, share their ideas, and showcase their research on current topics in health sciences – particularly with reference to Alberta ("Campus Alberta Student Conference of Health,").

4.3.4 Autonomous Strategic Behavior within Campus Alberta: Campus Alberta Health Outcomes & Public Health

Through a framework of provincially-integrated health outcomes, public health research and education system that involves the three Universities of the CARI sector (University of Alberta, University of Calgary, and University of Lethbridge), the vision is to improve health in Alberta ("Campus Alberta Health Outcomes & Public Health").

This means that by having high synergy and intensive collaboration among the Universities and other stakeholders in the province, there can be an alignment amongst creativity, educational programs, expert researchers, entrepreneurs, and objectives of health-related organizations; thus, leading to a province that is internationally recognized as a foremost innovational region that enhances profitability of market, along with improving health and enhancing social conditions of Albertans. As a result, the province will be a stationhouse of research and knowledge dissemination in the field of health

science; in addition to providing better health services to the population ("Campus Alberta Health Outcomes & Public Health").

Aside from the three Universities of the CARI sector, there is the possibility for other interested entities to become part of this platform. For instance, an entity that provides training to paramedical personnel can join this collaboration

By embracing a generic definition of what constitutes a public health, it allows a potential stakeholder in this autonomous strategic behavior to link their research/objectives/products to factors that affect the health of populations. This means that the potential stakeholder's research/outputs/products are linked to how individual, societal and globalized forces are influencing perception of public health in the province ("Campus Alberta Health Outcomes & Public Health").

4.3.5 Autonomous Strategic Behavior within Campus Alberta: Campus Alberta Central

Being designated as Comprehensive Community Institutions within Campus Alberta, Olds College, and Red Deer College have the responsibility of stewarding rural post-secondary education in the province. Consequently, this has led them to come together to create a joint venture called Campus Alberta Central (CAC), with the result that now there is an organization that is focused on advancing community-based learning for rural learners. The task of managing community affairs with job commitments and having families have resulted for rural learners to have limited opportunities to pursue education. As such, CAC can fulfill this need/requirement of theirs and provide them the opportunity to accomplish their learning aspirations and goals ("Campus Alberta Central,").

This becomes possible by engaging with community-based learning organizations that are localized learning sites in the rural region of the province. As a result, it becomes possible for the learners to access programs and courses and be provided assistance in acquiring learning while living along with their own community's members ("Campus Alberta Central,").

Accordingly, the presence of this joint venture leads to the expectation that this can become a valuable component of the advanced learning system to meet the societal needs of the province. For instance, from this joint venture there can be a better alignment between the requirements of the labor market and the availability of potential laborers from the communities in the rural Central Alberta. This then leads to constructing an effective bridge between industry, society, and educational objectives that lead to a stronger economic region having greater market opportunities ("Campus Alberta Central,").

With an increase in demand for credit programming across Central Alberta, there is an opportunity to provide post-secondary courses through the framework of CAC. As for the issue of face-to-face training in those communities that do not have significant learners/critical mass interested in a particular field that has the potential to benefit industry and society, then this can be delivered by face-to-face trades training through mobile classrooms ("Campus Alberta Central,").

It is worth highlighting that the province tends to a North (University of Alberta)/South (University of Calgary) orientation and that, perhaps, Red Deer College (located equidistant between) aims to become Red Deer University. This makes CAC a useful political placeholder.

4.3.6 Burgelman Model: Strategic Context Determination

The relationship between autonomous strategic behavior and the present comprehensive strategy is mediated through strategic context determination. This reflects the efforts that initiators of new categories put in linking their autonomous strategic behaviors into the current concept of organization's corporate strategy. In order for this to transpire, these behaviors need to be evaluated. This is done by the strategic context determination; critically, it is Burgelman's insight that this evaluation step be dissimilar from the structural context in significant ways. Were the structural context deals in months for an action to become viable, the strategic context allows years for ideas to bear fruit. Constraints are proscribed, not prescribed. The strategic context is a space to innovate, an experimental test bed. It features slack resources and incubates potentially disruptive, radical changes to the system.

4.3.7 Strategic Context in Campus Alberta

To balance the indeterminacy relationship that exists between autonomous strategic action and the system's current strategy, the strategic context of Campus Alberta needs to be defined (Burgelman, 1983, 2002).

The strategic context is where the phase of evaluation and selection of autonomous strategic actions transpires. This occurs through interaction between the originators/designers of the autonomous strategic actions in the presence of supportive, long horizon thinkers who understand the current strategy of Campus Alberta but are able to operate outside its boundaries and recognize the way forward. Consequently, an essential function of the strategic context determination is to create a link between new opportunities and the existing system's comprehensive strategy. As such, this will provide an option to

evaluate the adaptive potential of the autonomous strategic initiatives in an informed manner.

It is important to realize that in this context there are certain conditions/elements that are to be observed/monitored when new-order creation appears in Campus Alberta. Therefore, the strategic context provides the general indicators that are to be observed for ensuring that the system health of Campus Alberta is sustainable, adaptable, diverse and resilient. Through these indicators in the strategic context determination, Campus Alberta will be able to evaluate and understand the strategic importance of new autonomous strategic behaviors, and then select those autonomous strategic actions outside the induced strategic loop/process with the potential to enhance the adaptive fitness of the system – not just draw resources.

Since the strategic context determination provides the indicators for monitoring the system health of Campus Alberta, this would then suggest that the strategic priority, System Sustainability, should not be considered in the structural context determination, but in the strategic context determination. This is because the strategic priority "refers to a healthy vibrant system that is resilient, adaptable, and diverse" (Advisory Team, 2014, p. 14) and places strong strategic focus on the system's health so that the system can "pursue long-term success and continue to derive value for the province into the future" (Advisory Team, 2014, p. 14).

To ensure that autonomous strategic behaviors do not drastically change the comprehensive strategy of the system and move Campus Alberta either in the direction of (R_{c1}) or (R_{c2}) regions, it becomes necessary then to maintain and manage the system's sustainability through damping mechanisms (McKelvey, 2002). Consequently, the

influence of structural context determination on strategic context determination would also provide the needed dynamism for ensuring that Campus Alberta remains between the critical values of (R_{c1}) and (R_{c2}) and behaves a self-organizing system.

In the concluding chapter, I will use complex adaptive systems thinking to provide a theoretical insight into the conditions, elements and indicators of the strategic context determination and then suggest practical implications. In addition, I will look at two autonomous strategic behaviors (Campus Alberta Neuroscience and Campus Alberta Central) and observe if an appropriately configured strategic context determination would provide encouragement for these potentially disruptive initiatives to move forward or not.

5 Conclusion

Findings from the previous chapter demonstrated that the framework of Campus Alberta structurally fits into Burgelman's Model. Presently, the framework of Campus Alberta provides the context for new-order creations to materialize. Emerging autonomous strategic behaviors are made possible because the system's conditions situate Campus Alberta to remain in the region of complexity; thus, to function as a self-organizing system. For Campus Alberta to be a self-organizing system during extended periods of its life-cycle, it is necessary to construct the dimensions/facets of strategic context determination.

The strategic context determination is the space that will monitor and provide timely information and insights about the overall health of the system; in addition, have adjustable tools to manage co-evolutionary dynamics so that new-order creations do not shift the system away from the region of complexity. Based on these two generic functions, the strategic context determination is bifurcated into two components: monitoring the health status of the system as a self-organizing system, and then to manage emergent order, so that the system retains its capability to self-organize should the autonomous behaviors be incorporated into Campus Alberta's comprehensive strategy.

In other words, the conduct/role of strategic context determination is to, firstly, monitor the health of the system: scanning the system for conditions that nurture emergence of new-order creation; and secondly, to manage these emerging orders: methods of controlling the rate of co-evolutionary dynamics through damping mechanisms; henceforth, the system's health retains its capability of self-organizing processes and novel adaptation to the drivers of the ecosystem.

To begin with, I will describe the distinct – yet simultaneously interrelated – conditions that provide the space of possibilities for new-order creations to emerge. I will go on to describe how these conditions are currently embedded in the landscape of Campus Alberta; thus, the system is able to generate autonomous strategic behavior.

The next discussion will be on presenting the second conduct/function/role of strategic context determination: managing new-order creations – which arise from co-evolutionary dynamics – by using damping mechanisms. These are adjustable tools that facilitate a real-time user interface to ensure that new-order creations are adaptable to the drivers of the ecosystem, and can be slowed if an emerging order gets out of hand. In other words, adjustment of the rate of the co-evolutionary process is managed through damping mechanisms; therefore, conditions appearing during the co-evolutionary process are identified and then responded through enabling or inhibiting damping mechanisms.

Third, a prototype-illustration will be presented to demonstrate the potential effects of autonomous strategic behaviors on Campus Alberta. Such an exercise will portray the possibility for the system to gain and then analyze information about emerging new-order. As such, the system is in a position to make a decision if the emerging order is to be encouraged or discouraged through damping mechanisms.

Last, I will conclude with the theoretical contributions and policy implications that my study makes.

5.1 Emergence of New-Order Creation: Necessary Conditions Embedded within the System

New-order creation emerges in a complex system when the system exhibits conditions of three sets of complementary pairs: specialization – the existing tension

between internal diversity and internal redundancy; trans-level learning – enabling interactions amongst agents through decentralized control; and enabling constraints – balancing randomness and coherence (Davis & Sumara, 2006).

Besides these three sets of complementary pairs, Davis and Sumara (2006) have noted that there are other conditions that may also play a role in generating new-order creations. However, these are not "well-developed in human social systems" (pg. 151) and mainly found "to operate on biological or tacit levels" (pg. 151). Since my research is studying a human-integrated social complex system, I have focused only on the three sets of complementary pairs.

These three sets of complementary pairs configure the system's setting to unleash emergence of amalgamated possibilities and novel creation at distinctive edges of the organizational spectrum. Consequently, by acquiring value-enhancing capabilities, it becomes possible for the system to adjust/respond continuously, and thus adapt to the various drivers of the ecosystem.

On account of these conditions being interdependent and complementary with each other, connection and linkages are formed between the activities of the localized agents and nearby agents, and with the global attributes and properties of the system. Consequently, various arrangements that are initially formed due to the aspirations of agents may then be transformed into a unified echo of grander collective possibilities so that the system may achieve its ultimate outcomes and objectives.

Such differential orderings are the product of diverse summation of networking that branch/spread between the agents of the system. For this to happen it is essential that agents be given the opportunity to take a collective decision, not coerced into choosing an

interpretation, and facilitated to arrive at a conclusion based on collaboration amongst themselves. Accordingly, the system will then stand to function as a self-organizing system.

5.1.1 Monitoring of Necessary Conditions by Strategic Context Determination: Specialization – Existing tension between Internal Diversity and Internal Redundancy in Campus Alberta

Before describing the potential indicator that needs to be monitored by the strategic context determination for 'specialization' condition, I will briefly define internal diversity and internal redundancy; the extended definition was provided in the literature section.

The amount of internal diversity present in a system is reflected by the range and forms of conceivable responses that the system can offer depending upon the degree of heterogeneity present amongst the agents of the system. The complementary condition to internal diversity is internal redundancy. With this arrangement, the system holds extra-variance that matches the ambiance of variance found in the landscape of the ecosystem. Some researchers of complexity science suggest that a system's variance should be greater than the variance found in the external environment. In either situation, the target is to have a system that displays the condition of internal redundancy alongside internal diversity. Similar understanding has been provided by McKelvey (2002) through his discussion about Ashby's Law of Requisite Variety (1956) and Allen's Law of Excess Diversity (2001). The former provides the notion that is related to internal diversity while the latter is associated with the notion of internal redundancy.

Specialization – dynamic combination of the complementary pair – is a back and forth channel of a continuous dialog between internal diversity and internal redundancy.

The condition of internal diversity encourages variation-enhancement – within the system – and is outward-oriented: enables the system to arrange for novel possibilities in response to changing dynamics of the ecosystem. Meanwhile, the condition of internal redundancy, systemizes and solidifies the routine and habituated interactions amongst the agents of the system and is inward-oriented. Therefore, through this continuous dialog there is a balancing level formed between the sources of new-order creation and the sources of stability in the system.

The finding from studying Campus Alberta through Burgelman's Model in Chapter 4 provides demonstrative evidence that the conceptual framework of Campus Alberta exhibits the complementary pairing of internal diversity and internal redundancy. That is, the six sector model of Campus Alberta corresponds with these two conditions.

The post-secondary institutions in Alberta are segmented into a six sector model and operate under the authority of the Post-secondary Learning Act (PSLA) of Alberta. There are a total of twenty-six post-secondary institutions segmented into a six sector model: Comprehensive Academic and Research Institutions (CARI), Baccalaureate and Applied Institutions (BAI), Polytechnical Institutions (PI), Comprehensive Community Institutions (CCI), Independent Academic Institutions (IAI), and Specialized Arts and Culture Institution (SACI).

Each segment within the six sector model has its specified mandate that is enacted in the PSLA. What is readily perceivable is that each segment of the six sector model has multiple/different institutions; as such, the condition of internal heterogeneity within the structure of Campus Alberta is exhibited. In addition, each of the twenty-six institutions

endorse those roles and behaviors that focus on meeting the mandated requirement that are established in the PSLA.

Within the CARI sector, there are four institutions; two institutions in BAI sector; two institutions in PI sector; eleven institutions in CCI sector; five institutions in IAI sector; and two institutes in SACI sector. This form of classification indicates that Campus Alberta has extra-variance that provides internal redundancy in the system: each segment of the six sector model has multiple agents that perform similar roles and behaviors in meeting the requirements and mandates of that particular segment.

The possible indicator that needs to be monitored by strategic context determination for this complementary pair is the '*number and percentage of post-secondary institutes present in the different sectors of the six-model'*. The rationale is that the system will be informed through this indicator as to the level of heterogeneity and redundancy present in the system. Currently, the system is able to exhibit this complementary pair at a balanced level. However, if one of the post-secondary institutions, for instance, moves from BAI to CARI then this informs the system that there is a decline in the level of heterogeneity in one sector that may have a negative cascading effect on the overall functionality of the system. Moreover, such a loss of agent diversity from one sector to an increase of agent diversity in another sector may signal the synchronization of agents moving the system above (R_{c2}), thus, resulting in undifferentiated set of agents dissolving all opportunity for exchange and cooperation.

5.1.2 Monitoring of Necessary Conditions by Strategic Context Determination: Trans-level learning – Incorporating decentralized control and neighbor interactions in Campus Alberta

Before describing the potential indicator that needs to be monitored by the strategic context determination for 'trans-level learning' condition, I will briefly define neighbor interactions and decentralized control; extended definition was provided in the literature section.

Davis and Sumara (2006) have given a novel interpretation of the nature of neighbor interactions in a learning system. Their definition refers to contacts between ideas, notions, mental models and prototype schemata between agents of the system. The complementary condition to neighbor interactions is decentralized control. Such a condition refers to the notion that if co-evolutionary dynamics are to transpire and produce new-order creations in the system, then it is essential that agents within the structure and hierarchy of the system relinquish any desire to control the processes, mechanisms and outcomes of the system. It does not mean that there should not be a constituency that organizes proceedings, facilitates episodes of interactions, and encourages dialog between agents. Rather, what is meant in the context of complexity science is that multiple-interpretative possibilities – that result from neighbour interactions – are not to be constricted, or that one interpretation is chosen as the optimum explanation by agreement amongst a few selected agents. McKelvey (2002) has also presented similar remarks without specifying the form of neighbor interaction; he argued about agents requiring adaptive capability and the need to interact and mutually influence each other so that novel adaptation can appear in a system.

The finding from studying Campus Alberta through Burgelman's Model in Chapter 4 provides demonstrative evidence that the conceptual framework of Campus Alberta exhibits the complementary pairing of decentralized control and neighbor interaction. That

is, phase of emergence, development, and extension of the conceptual framework of Campus Alberta corresponds to these two conditions.

The current structure of Campus Alberta having a six sector model, along with the principles framed regarding the roles and mandates of post-secondary institutions in the Post-secondary Learning Act (2004) came through sharing of ideas, and mental models. These proposals were then agreed consensually by the stakeholders of Campus Alberta. Moreover, to ensure that there is a continuous evolutionary growth in the framework of Campus Alberta, a document entitled 'Campus Alberta Interim Strategic Plan' was recently drafted to present short-term strategic plans and a proposed process to develop a more formal plan through initiation of Campus Alberta Strategic Directions Committee. The members of this committee include the Board Chairs from the 26 publicly funded post-secondary institutions, and the committee is chaired by the Minister of Innovation and Advanced Education. Such a setting provides another opportunity for developing short-term and long-term strategic directions for Campus Alberta through neighbor interaction within the context of consensual authority.

The possible indicators that might be monitored – in the following order – by the strategic context determination of Campus Alberta for this complementary pair are: '*for each individual sector, the number of times strategic committee of institutions have met each other in a year for sharing of knowledge/information/ideas'*; then, *'the number of times strategic committee of institutions in all the six sector have met each other to share knowledge/information/ideas within a year'*; and lastly, *'the number of joint collaborations amongst the institutes in/between segments of the six sector model in a year.'*

It is necessary for the system to be aware of the number of opportunities that exist between the post-secondary institutions for the purpose of information/knowledge/ideas sharing with each other. The initial contact of knowledge/information/ideas should be between neighbor agents within a segment: such forms of contact would facilitate the institutes to produce actions that meet the segment's mandate, along with mutually influence each other. Moreover, this will provide the institutes to evolve towards a higher level of adaptability to the drivers of the eco-system.

Such a sharing of information in each of the segment needs to be summated between all the institutes amongst the six segments so that the overall system is able to further enhance its learning capability, best practices are not hoarded in one segment but spread across the boundaries, and interpretative understandings of the drivers of the ecosystem are recognized amongst the institutions. As a result, there would be a number of joint collaborations taking place amongst agents – between/within segments – in order to acquire opportunities or deflect threats coming from the ecosystem through their combination of resource-pool; and thus, leading to Campus Alberta gaining competitive advantage relative to other advanced learning jurisdictions.

5.1.3 Monitoring of Necessary Conditions of Strategic Context Determination: Enabling Constraints – Balancing Randomness and Coherence in Campus Alberta

Before describing the potential indicator that needs to be monitored by the strategic context determination for 'enabling constraints' condition, I will briefly define randomness and coherence; the extended definition was provided in the literature section.

The structural design of the system plays a prominent role in mediating the creation of the sources of coherence and sources of randomness: this act balances collective focus

to maintain comprehensive strategy of the system with constant adjustment and adaptation of the system's setting to the drivers of the eco-system. Such a bi-contextualization of the system provides two important functions: enabling coherence and stability in the system, and generating randomness/noise in the landscape of the system so that new-order creations can appear.

The finding from studying Campus Alberta through Burgelman's Model in Chapter 4 provides demonstrative evidence that the conceptual framework of Campus Alberta exhibits the complementary pairing of balancing randomness and coherence. That is, the conceptual framework of Campus Alberta corresponds with the two strategy processes of Burgelman's Model: autonomous and induced; induced process can be considered as an exploitative progression while the autonomous process can be likened to an explorative development (March, 1991).

Since the framework of Campus Alberta aligns and fits into Burgelman's Model, this demonstrates that the post-secondary learning system also generates autonomous strategic behaviors and induced strategic behaviors. It is observable that the conceptual framework of Campus Alberta provides two significant functionalities: system-stabilization derived from a constraint-context and arrangement of absorptive-setting to encourage emerging of new-order creations.

The possible indicator for this condition is the '*number of new-order creations in comparison to number of induced strategic behaviors (e.g. joint collaboration backed by Access to Future Fund) that emerge in a given year within Campus Alberta*'.

Monitoring by strategic context determination of such an indicator allows for the system to become aware of the potential level of randomness/noise versus the level of

stability/coherence in the system. Depending on the factors, e.g. effect of the drivers in the ecosystem, the system may prefer to have higher level of one characteristic in lieu of the other. For instance, if the drivers foreshadow a volatile and fluctuating landscape of the ecosystem, then perhaps it is better for the system to have heightened level of innovation for gaining competitive advantage; or when the province is in a period of recession then short-term planning, e.g. yearly plan, should focus on generating greater level of induced strategic behaviors, and long-term planning should be towards generating higher level of autonomous strategic behaviors: in this way, the province will have greater possibility to move from the recession phase by means of economic growth.

5.2 Strategic Context Determination: Managing Co-evolutionary Dynamics through Damping Mechanisms

After the strategic context determination has monitored and provided information about the status of the system's health for generating autonomous strategic behavior, its next role/function is to ensure that a new-order creation does not cause the system to move away from the region of complexity: a forward/backward shift that moves the system out of complexity region and causes the system to have diminishing self-organizational and adaptive capabilities.

It is important to recognize that not all co-evolutionary dynamics are favorable for the system. There is a possibility that the resulting effect of coevolutionary dynamics (which is an emerging order) may cause the system to have weakening capability of adapting to changing drivers of the ecosystem. The emergence of autonomous strategic behaviors is made possible only if the system is a self-organizing system. For the system

to remain in such a state, it is essential to manage the impacts of new-order strategic behaviors on the system.

The managing of co-evolutionary dynamics is done firstly by detecting if concerned indicators are visible or not, and then subsequently enabling or inhibiting the damping mechanisms that act as adjustment tools. These relevant indicators are the conditions that may appear with the continuation of an autonomous strategic behavior and negatively affect the health of the system; the damping mechanisms will enable or inhibit these specific instances in new-order creation. As a result, Campus Alberta will be in a position to understand the strategic importance of the autonomous strategic behaviors it identifies and select those instances of emergent order that are outside the induced strategic process; yet, show promise for the system to gain significant learning processes of adaptation.

The point is that strategic context determination provides the tools for managing a new-order creation. This ensures that an emerging order should not so drastically change/alter the comprehensive strategy of the system as to shift Campus Alberta beyond (R_{c2}), resulting in Campus Alberta becoming a chaotic system; or allow it to slide back into complacency towards (R_{c1}) and make Campus Alberta a deterministic system. This insight returns us to the necessity to maintain and manage the system's sustainability through damping mechanisms. As such, the influence of both structural context's and strategic context's mechanisms of monitoring and evaluation should ensure that the needed conditions for generation new-order creations is present in the system and thus Campus Alberta remains between the critical values of (R_{c1}) and (R_{c2}) as a self-organizing system.

Consequently, it is a necessary feature of a system – which wishes to remain in the region of complexity – to have those damping mechanisms that might logically be used as

a means of managing the impact of autonomous strategic behaviors on the system's capacity to self-organize. These damping mechanisms are to be chosen carefully and not just based on rational optimization/or political opportunism.

5.3 Strategic Context Determination: Damping Mechanisms

In the setting of strategic context determination, the types of damping mechanisms are the adjustment tools used for controlling the process of co-evolutionary dynamics; new-order that is totally disruptive is tamed while the functional one is encouraged. The required focus is to identify aspects of system health that might logically be used as a means of assessing the impact of autonomous strategic behaviors on Campus Alberta's overall health and sustainability, and then managing these emerging orders. As always, one has to be vigilant to identify those indicators that might identify instances of emergent order based on rational optimization (or political opportunism) by individual institutions but which are not in the apparent best interests of the larger system.

1) Loss of Agent Diversity: A system adapts best to an external environment if it contains within itself at least as much variety as exists within the environment to which it is attempting to adapt. Having agents connected to one another is good for adaptive growth but only if agents are different from each other. This is the network tension between closure (strong ties) and brokerage (weak ties) (Burt, 2009). Organizations, especially if they are successful, often tend toward homogeneity. As noted by McKelvey:

> The problem is, how to maintain agent diversity in the face of: (1) tendencies to form tight cliques that tend to produce group-think (Janis 1972); (2) tendencies toward strong command-and-control systems that assure reliability but tend to produce organizational inertia, uniformity and little change (Hannan and Freeman

1984); (3) corporate cultures that reduce heterogeneity (Martin, Sitkin and Boehm 1985); (4) selection tendencies that replicate the founding leader (Kets de Vries and Miller 1984) or (5) visionary charismatic leadership that tends to produce homogeneity (McKelvey, 2003).

To speak to the post-secondary learning context with respect to loss of agent heterogeneity, an emergent behavior of most unconstrained advanced learning systems is what is termed 'Carnegie creep' in the US, i.e. the loss of system diversity due to the tendency of institutions to seek to 'move up' to the research university categories. While this behavior is a rational response by individual institutions to incentives at that level (funding, reputation), it is generally not seen to be in the best interests of the overall system which should respond to a diversity of needs for needs for both applied and basic research, both education and skills training, variations in access, etc.

Complex adaptive systems theory also holds that increasingly diverse agent responses to idiosyncratic tensions at some point move the system above (R_{c2}), i.e., above the edge of chaos and into the region of chaos. Additional complementary perspective suggested by the theory is that the loss of agent diversity is also a signal that the synchronization of actors may be moving the system above (R_{c2}). It may be counter-intuitive to imagine how the synchronization of agents within a system can lead to collapse but consider cases of herding behavior such as runs on banks, the famous ‘toilet paper shortage’ hoax or the fact that the stock market crashes exactly when everyone wants to sell. Thus, the system has to be aware of the indicator of loss of agent heterogeneity and place such damping mechanism in place that enable the managing of agent heterogeneity. Such damping mechanism will depend on the context of the system. What is important is

to realize that an undifferentiated set of actors dissolves all opportunity for exchange and cooperation.

2) The Loss of Weak-Ties: The presence of weak ties between networks, i.e. agents that span 'two worlds,' is critical for the flow of novel information and adaptive response. Work done in GE's ascendancy gives a good indication of ways to limit the sealing off of networks into dysfunctional isolation:

> GE's 'simple-rules' that, among other things: (1) prevent 'best practice hoarding' so as to get good ideas out into the GE network and moved across boundaries; (2) abstract these ideas to the point where they are broadly generalizable; (3) make resources available to people to try new ideas; (4) set up 'popcorn stands' as places where new ideas can be safely tried out without damaging the rest of GE; coupled with (5) their policy of promoting successful managers into new positions where they might fail, all work to keep weak-tie construction and subsequent order creation alive (Kerr 2000).

Once again, while incentives at the institutional level may encourage the development of bonding social capital among similar schools – Big 10, Ivy League, etc., the flow of learners, research ideas and administrative innovations across the interstices of the larger system depends upon the development of bridging social capital at the systems level.

3) Network Failure at the Nodes: In addition to problems with linkages between nodes in the system network, there may be deterioration of the capacity of the nodes or agents themselves. Argote (2012) found that one of the systematic inhibitors of adaptation was the failure of agents to know 'who is good at what.' Individual agents must also work

to enhance their idea creation capability, recognize and limit susceptibility to 'not invented here' syndrome, and develop their ability to sell new ideas to other agents.

Organizational learning has also been found to suffer from the inability to proceed based on a lack of what is called 'absorptive capacity' that would equate to the first critical value. This is akin to having to 'prime the pump' with some amount of base or fundamental knowledge in order to get information production flowing. Research on transdisciplinary solutions that reconcile policy, research and practice in the face of both the contested values of society and the contested knowledge of researchers is demonstrating that the formation of a common research object is antecedent to the production of new knowledge and able to contribute to both societal and scientific progress (Jahn et al., 2012).

Genuine cooperation and joint competency leveraging based upon trust among agents (in the case of Campus Alberta, among individual institutions) will only be built if the government places adaptive tensions at the appropriate level. The message here for RBB is that outcomes-based resourcing should be allocated at the sectoral, not institutional level, with outcomes measured at that level as well. This would encourage inter-institutional learning to generate collaborative solutions and efficiencies. However, such a move would be a difficult political proposition and likely create a nightmare of intra-sectoral wrangling in those sectors with extreme power imbalances among institutions.

4) Separation from Adaptive Tension: As noted earlier, productive co-evolution only takes place when agents are under pressure to adapt to some contextually imposed problems. In the strategic management literature as applied to industry analysis, Porter's Five Forces (threat of new entrants, power of buyers, power of suppliers, rivalry, and substitutes) all provide such tensions. In this case, coevolutionary self-organization at the

firm level occurs when the drivers most relevant for them to confront are engaged by agents employing boundary spanners at the organization/environment interface.

The attempt to articulate outcomes and indicators for Campus Alberta that are relevant to the legislated RBB exercise is precisely the kind of orienting adaptive tension that is needed but it must be directed at the appropriate level – the sectoral level. While 'steering' is always an imperfect tool by definition, it does have the effect of focusing agent's attention on the resources, technologies, products and processes required to achieve the indicated outcomes.

Thus, after the evaluation of the potential effects of new-order creation on the overall health of the system, the damping mechanisms are used as regulative tools to maintain the system between the values of (R_{c1}) and (R_{c2}).

5.4 Application of Strategic Context Determination: Campus Alberta Neuroscience

Campus Alberta Neuroscience was launched in 2009 and became a connecting node across three of the four CARIs to bring applied researchers, basic scientists, and practical clinicians together. The aim of Campus Alberta Neuroscience has been to deliver actual and quantifiable long-term results in advancing solutions to mental and neurological illnesses through easing the flow of aggregated and production of knowledge amongst the research professionals. Also, this will have the added advantaged of transforming the recognition of the province as being the best destination for brain researchers and where collaboration among leading research scientists takes place ("Campus Alberta Neuroscience,").

On account of such an approach being taken by Campus Alberta Neuroscience, there is potential for translating pure scientific knowledge into new medical-related

products. This can then profit the medical/hospital industry and social industry, and also create an awareness amid Albertans of the link that exists between quality/ standard of living and brain science.

Campus Alberta Neuroscience is focusing on ensuring that there are mediums of facilitation for new collaborations. Included are: Team Formation Program, Academic Exchange (CANAE) Program, Trainee Mobility Program, and International Scholars (CANIS) Program.

It is very much perceivable that Campus Alberta Neuroscience is encouraging new networking amongst the institutions of CARI through recognizing the need for increased heterogeneity. Their statement reflects this through placing emphasizes that it is better to have 250 researchers from the three university working together; rather, than each university tackling mental and neuro illnesses on its own. Therefore, the programs of Campus Alberta Neuroscience are building bridges, enhancing cooperation and collaboration amongst the neuroscience community of Alberta, and between the neuroscience community of Alberta with prominent international mental health experts and neuroscience researchers ("Campus Alberta Neuroscience,").

In addition, and potentially most disruptive to the current system, Campus Alberta Neuroscience has piloted joint course instruction across the three participating institutions. While a natural outgrowth of research collaborations, this initiative raises several issues with respect to course ownership, tuition receipt, delivery format, intellectual property, and classroom / curriculum coordination. None of these issues is insurmountable, but the system level potential to trigger rationalization of instructional resources across institutions is particularly significant.

Evidently such forms of collaboration can provide extra-variance to the system in comparison to the variance of the ecosystem. In the case of Campus Alberta Neuroscience, we can establish that this new-order creation will not reduce the system's level of heterogeneity; thus, will not raise the alarm about system health.

It is also noticeable that this autonomous strategic behavior allows the system to maintain the strength of weak ties; rather than cause loss of weak ties. Intended targets and delivery of results are made possible through collaboration that allows summation and production of knowledge amongst the agents without barriers of standardized forms of communicative procedures or structurized layer of hierarchy that stifles innovation.

Another manner by which this new-order creation is indicating its potential effect to facilitate the system to remain in the region of complexity is by ensuring that the capacity of the nodes in the network remains intact. Such a possibility arises because the emerging initiative also focuses on having collaborations/networkings with international researchers that result in limiting the susceptibility of 'not invented here' syndrome.

Based on the description that I have provided on the Campus Alberta Neuroscience initiative, it may not be a far-fetched position to consider this autonomous strategic behavior as a new-order creation that is beneficial for the overall health of the system; thus, to be nurtured and encouraged for further development.

5.5 Strategic Context Determination: Campus Alberta Central

Olds College and Red Deer College are two institutions placed in the segment of Comprehensive Community Institutions of the six sector model of Campus Alberta. The mandate given to them is to steward post-secondary education in the rural region of the province. Their response has been to work together and create a joint venture: Campus

Alberta Central. The focus of this joint venture is to advance community-based learning for rural learners. Since rural learners often have families and manage community affairs with job commitments, their busy lives sometimes limit their opportunities to pursue education. Accordingly, this emerging order can fulfill these needs and requirements by providing rural learners the opportunity for accomplishing their learning aspirations and goals while being close to home.

Subsequently, the presence of this joint venture leads to the expectation of becoming a valuable means for the advanced education system to meet the societal needs of the province. For instance, a beneficial effect of this joint venture is better alignment of the labor market requirements with potential laborers that come from the communities in rural Central Alberta. Such an impact can lead to constructing an effective bridge between industry's targets, society's goals, and educational objectives, thus, leading to a province that has stronger economic growth and greater market opportunities.

Keeping aside these justifications, it is worth reminding the reader that several of the province's post-secondary sectors tend to a North / South orientation anchored by the two major cities of Edmonton and Calgary. The 'Central Region' being developed in this initiative would actually represent only a thin strip of the rural market (Red Deer College is approximately an hour and a half north of Calgary and an equal distance south of Edmonton along the same north-south freeway). In contrast, the driving distance from Edmonton to Alberta's northern border is ten hours and the US border with Montana is three hours south of Calgary. Add to this geography the avowed intention of Red Deer College to be the 'next university' and its rural intentions seem less plausible than the role of Campus Alberta Central as a political placeholder. Consequently, they do not perceive

‘who is good in what’ and are overstretching their limited resources and distinct competencies; thus, a higher probability for the system to have ‘network failure at the nodes’.

Another issue is the ambition of Red Deer College driving the Campus Alberta Central initiative. Its aim to move from college level to university level is making the individual institution move from a CCI sector (that is needed for the economic growth of Alberta) to a sector that already has agents that are good at what they do while having the required resources; thus, reducing loss of agent diversity.

Based on the analysis that I have provided on Campus Alberta Central, it becomes discernible that this autonomous strategic behavior is displaying the potential to cause an unfavorable impact on the overall health of the system. Therefore, this emerging order needs to be redesigned towards a new direction that will ensure that Campus Alberta remains a self-organizing system and stays in the region of complexity.

5.6 Practical Implications

The world of today is driven by unpredictable forces with multitude challenges appearing – with the coming ones seeming more insurmountable. The role of advanced education in sustaining economic growth for many nations across the globe has become an open question of uncertainty. Fortunately, as Albertans, we already have an engine in place for prosperity. An ongoing stream of research is continuously demonstrating that an advanced learning system that forms new configurations of knowledge is an essential force of steering the society towards prosperity.

To let the seeds of innovation grow in the post-secondary system – so that our society may prosper – requires proper nurturing of the system. Unfortunately, the subject

of managing higher education instills actions – and reactions – that are anchored on two planes: competing socio-political ideologies exemplified by the representative body of our society and heightened sense of reservation about autonomous nature of advanced learning institutions. It is important that any theoretical contributions and practical implications do not encourage the formation of myopic strategy.

The provincial government recognizes the importance of the post-secondary education system for social development and economic growth of Alberta. As such, it has taken a responsible and measured decision by involving and collaborating with various stakeholders during the reviewing stage of the post-secondary institutions.

The first step is the recognition of introducing complex adaptive system thinking into a system's RBB modeling and setting up 'system health' indicators. This initial step has been taken by Campus Alberta. It is important for the stakeholders to realize that a system functions most efficiently when it remains in the region of complexity; thus, the need for having such indicators that monitor this state of system's health.

It is important that such indicators are developed that are able to identify the required conditions that allow the system to generate autonomous strategic behaviors. However before proceeding further, it is important to realize that generating autonomous strategic behavior is one side of the equation; the other side is generating induced strategic behavior within the system. Thus, it is important for the system to be aware that it is able to generate both forms of strategic behavior. I was able to demonstrate that the conceptual framework of Campus Alberta fits into Burgelman's Model; hence, generating both types of strategies.

Often it happens, that during the phase of strategic formulation, all types of strategic indicators are placed in the framework of structural context determination; likewise, Campus Alberta has followed the same course. It is important to recognize that any strategic priority that is linked to the concept of system sustainability and refers to the system trying to remain healthy, vibrant, resilient and adaptable needs to be placed in the strategic context determination.

The suggested indicators to be measured to observe if a system can generate autonomous strategic behavior can perhaps be expanded, but the ones I have mentioned are the essential indicators. I believe measuring these conditions will provide information about the current health status of Campus Alberta to produce new-order creations.

The system remains vibrant as long as the emergence of novel arrangements is possible. If Campus Alberta (or any other system as a matter of fact) loses its ability to operate as a self-organizing system, then the system may transform into any of the two forms: deterministic or chaotic. In either case, the processes of the system, in the long run, will display heightened level of dysfunctionality and be less attuned to changing dynamics of the eco-system.

The work has highlighted that to maintain the system as a self-organizing system it is important to build into the overall RBB evaluative machinery such conditions that can be monitored when new-order creation appears in Campus Alberta. In this way, it is the strategic context determination that incorporates the general indicators for ensuring that system health of Campus Alberta is sustainable, adaptable, diverse and resilient; thus, remaining in the region of complexity.

Consequently, an applied suggestion that my research offers to practitioners in the industry is '2M' - Monitoring the overall health of the system and Managing co-evolutionary dynamics. I am of the opinion that this applied approach (2M) can be used by other organizations in different industries: provided that the organizational system is complex, and the industry's environment is volatile and subject to changes. Consequently, the first step is to monitor those conditions that allow the system to remain in the region of complexity and produce new-order creations. Once the system is able to generate new-order creations, it is then important that these emerging orders are managed so that the system does not lose its continuing ability to adapt to the changing factors of the eco-system. The approach of 2M can only be applied properly when the right people with the right set of skills are positioned in the strategic context determination. In other words, strategic background determination requires a highly participative form of arrangement: composed of people/groups from multiple levels of the system who understand the system; moreover, sufficiently free from the constraints of the system. Therefore, the approach of 2M directs practitioners to recognize that the strategic context within the RBB framework operates as a separate evaluative mechanism for autonomous/emergent behaviors that are both potentially disruptive and potentially adaptive in fundamental ways.

With the price of oil at a decade low and the provincial budget projected to be several billion dollars in deficit, there is an expectation of continuously significant spending cuts to public institutions. Add to this that the RBB initiative and the development of a Strategic Plan for Campus Alberta have both been put on the back burner; one might say that the time was ripe to either acknowledge an apparent urgency for change or the biggest threat rigidity response on record!

Frankly, I hope that political fatigue around boom & bust economic cycles in Alberta will provide fertile ground for new ways of thinking. My supervisor, Dr. John Usher, has argued to the provincial government (and will probably do so continuously) that a Campus Alberta Strategic Plan should be less about forecasting what the system might achieve and laying plans to achieve it than understanding that a system that recognizes and responds to emergent orders through differential support is one that is best able to guide the overall system toward its three broadly defined outcomes.

In this way, the inputs of the 26 institutions – including the sometimes conflicting hopes and dreams of their students, faculty and administrators – can be responded to by government as they happen, with full information and openness; as initiatives with possible merit, not as divergent paths from some imagined master plan. It is important to recognize that the adaptive tension needs to be allocated at the sectoral level and not the institutional level. If done in this a way then there is a greater possibility of encouraging inter-institutional learning to generate collaborative arrangements that will allow the system to achieve its ultimate outcomes.

5.7 Theoretical Contributions

The operation of RBB management in its current form in many organizations stunts novel arrangement of dynamical interactions between agents; thus, diminishing the capability of the system to have new-order creation. Such an approach used for monitoring a system has a limited appreciation of recognizing that non-linear interactions drive development and sustain the growth of a human-integrated system. However, this does not mean that performance-based budgeting is an inoperable tool for improving the efficiency of the system. On the contrary, it is part of the solution to ensure that the system's health

remains in the region of complexity. In order to harness the full potential of RBB, it is important to embed this schema within a complex adaptive systems thinking, which in turn, is placed within an intra-organizational evolutionary framework.

My research has indicated that we need to expand our conventional concept of studying the condition of the system to adapt to its eco-system by including the theoretical contributions made by McKelvey (2002); mainly, that a system will be able to adapt to its changing ecosystem when it generates and manages co-evolutionary dynamics effectively. Therefore, the RBB process should incorporate such performing indicators that measure if the system is in complexity region and have managing tools to ensure that the system remains in the complexity region.

But to understand the RBB process from this new perspective requires a shift in our approach from comprehending system's dynamics as being linear-causation to appreciating that a system presents non-linear dynamics. When studying a complex adaptive system it is important to have a mental model that is operationalized so that findings are obtained about the empirical site, and then these findings can be interpreted in order to understand the overall health of the system. In consequence, a critical insight drawn from this thesis is the integration of Burgelman's Model with McKelvey's work by casting aspects of the latter as operationalizations of the former. In other words, the findings are gathered based on the conceptual framework of Burgelman's Model and then analyzed and interpreted in the light of McKelvey's work on managing complex adaptive systems. As such, I was able to postulate that the system needs to display those conditions that allow for new-order creation to emerge and then manage the effects of the emerging orders. In consequence, my research indicated that strategic context determination has two

generic functions: monitoring the health of the system and then managing co-evolutionary dynamics.

In conclusion, I was able to identify and incorporate into the larger set of RBB measures the general indicators needed to ensure that the system health of Campus Alberta is sustainable, adaptable, diverse and resilient by using McKelvey's work on damping mechanism. By building these indicators, a system (in our case Campus Alberta) is then able to understand the strategic importance of the autonomous strategic behaviors it monitors/evaluates, and then possibly select, those instances of emergent order which are outside the induced strategic process yet show promise for significant adaptive change, and not merely drain resources from the system.

5.8 Limitations

Studying Campus Alberta with the aid of documents provided me the possibility to investigate the empirical site within a real-life contextual situation. However, any form of evidentiary documents associated to an empirical site can simply be a 'window dressing' that does not properly reflect the reality of the site being studied. A way to strengthen the findings induced from the documents of Campus Alberta is to conduct interviews with multiple stakeholders of Campus Alberta, which would then allow the possibility of converging similar results through multiple sources of evidence.

In a subsequent work that incorporates the findings from the present research the present weakness has been addressed. As such, the succeeding case study in a research project that has been commissioned by the European Commission, and is jointly implemented by CHEGG at the Ghent University in Belgium and CHEPS at the University of Twente in the Netherland, for studying structural reforms in higher education, utilizes

interviews as another source of evidence. In this way the interviews that were conducted, with senior institutional and governmental administrators from the post-secondary sector in Alberta, provided the opportunity to determine whether the findings derived from the public documents of Campus Alberta were accurate.

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