Innovation Ecosystems: A Conceptual Framework

Prof. Martin Curley
Director, Intel Labs Europe
Intel Corporation
Industrial Director, Innovation Value Institute
National University of Ireland, Maynooth
Martin.G.Curley@intel.com

Prof. Brian Donnellan
Professor of Information Systems Innovation
Logic Annex, South Campus
National University of Ireland Maynooth
Maynooth, Co. Kildare, Ireland
Academic Director, Innovation Value Institute
National University of Ireland, Maynooth
Innovation Value Institute
Brian.donnellan@nuim.ie

Dr. Gabriel J. Costello
Galway-Mayo Institute of Technology
Galway, Ireland
Gabrielj.Costello@gmit.ie

Introduction

Why is an innovation successful in one organization and met with resistance in another? How is it that certain innovations diffuse easily through an environment while others just spin their wheels? What are the implications of new paradigms such as *open innovation* for our very understanding of the term? These are some of the questions that increasingly exercise the minds of managers, entrepreneurs, policy makers and academics as they grapple with the perennially important topic of innovation. After almost half a century of intense research and theorizing, the academic contribution to answering these questions is less than convincing. For example, in a review of the prolific growth in innovation publications, Wolfe [1] concluded that it had made little contribution to the understanding of innovative behavior in organizations. The results presented were largely "inconclusive, inconsistent and characterized by low levels of explanation" (p. 405). More recently, Fagerberg's [2] states that our understanding of how innovation operates is still fragmentary and "that further conceptual and applied research is needed" (p. 20). Whilst Teece [3] says "no study of innovation can ever claim to have the last word on the subject". The phenomenon is too complex, dynamic and adaptive to fit into a single conception for any extended period of time" Such characteristics prompt the examination of whether it is appropriate to look at new theories. Figure 1 outlines the progression of innovation from a closed innovation paradigm, to and open innovation paradigm to the recent formulation in terms of innovation networks.

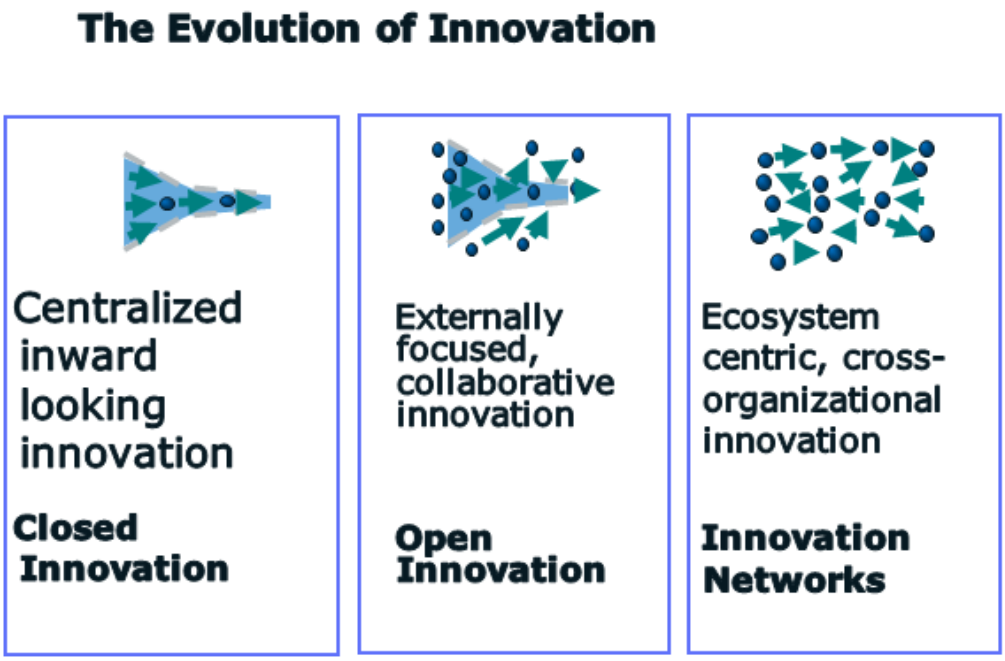

Figure 1. Evolution of Innovation (source Salmelin [4] after Chesbrough, Forrester and Von Hippel)

The evolution of innovation towards an ecosystem centric, cross-organizational configuration creates a compelling logic and case for exploring an ecological theory perspective [4]. Such an analysis prompts this research objective: To develop a theoretical framework that can position the person as the cornerstone of the innovation phenomenon; incorporate the broad spectrum of teams, organizations, inter-organizational networks and public policy; while treating these interconnections as dynamic interactions subject to the contingencies of time and history. The framework that we build on is that of ecological systems theory (EST) which provided a new perspective for research in human development when it was introduced by Urie Bronfenbrenner [5]. The benefits of the framework include: providing a fresh perspective for researchers to investigate the phenomenon; integrating the complexities and deficiencies identified in the literature; and presenting innovation as a dynamic interactive process resulting from the encounter between people and their environment with its technological capability. Jeff Alex[6]at SRI uses the metaphor of a biological ecosystem to describe the nature of a business ecosystem. A key characteristic of an ecosystem is that it is evolving with organic, diverse and symbiotic attributes. The principle of synergy is central – the idea that through collaboration entities can deliver something which is unattainable on one's own. Ecosystems are also complex adaptive systems. Once the raw materials are put in place and the initial relationships and couplings established they are often self-organizing and self-regulating according to Darwinian principles. In "Knowledge Driven Entrepreneurship" Andersson, Curley and Formica [7] define a business ecosystem as a network, or coalition, of resources, competencies, potential, energy, commitments, and promises to realise a shared profitable future. Geographical or virtual ecosystems can span or traverse a number of business ecosystems. Bill Aulet describes seven key pods that make up the innovation ecosystems: Government, Demand, Invention/Innovation, Funding, Infrastructure, Culture and, most importantly, Entrepreneurs/Innovators themselves framework and explain why it makes a contribution. See Figure 2 below viewing the Innovation Value Institute as an innovation eco-system.

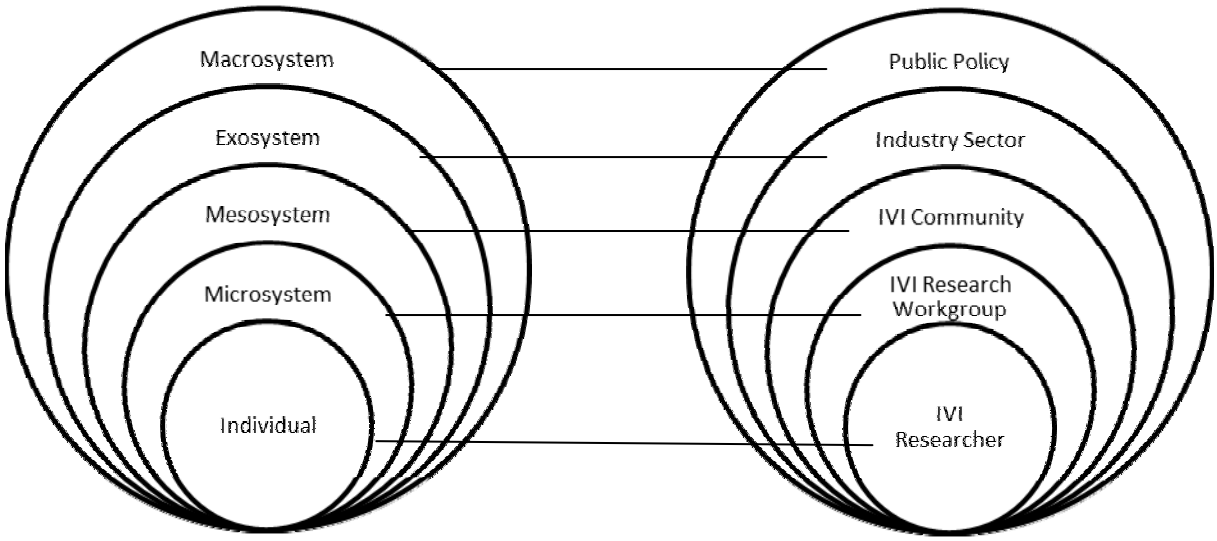

Figure 2. Innovation Value Institute as an Innovation Eco-System

Background

The seminal Minnesota Innovation Research Program (MIRP) concludes that further theoretical development is required to incorporate local and global phenomena "at different levels of analysis, such as how individuals *relate* to project teams, teams to organizations, organizations to a larger industry community" (p. 641 [8]). Storey [9] in his review of key articles from over 30 years of research, emphasizes the growing prevalence of alliances and inter-organizational networks with their increasing importance for innovation. A prominent theme emerging from studies in the area is the subject of social relationships that includes factors such as "persuasion, influence, politics and power" (p. xxviii [6]). The growing significance of the *Open Innovation* paradigm has prompted West, Vanhaverbeke and Chesbrough [10] to propose a research framework with the following classifications: individual, organizational, value network, industry/sector and national institution (p.288 [7]). In related work, Vanhaverbeke and Cloodt [11] suggest that emerging forms of value networks must be examined at the level of different nested layers. These diverse layers span the spectrum from the individual; to firms-organizations; through Dyads; onto inter-organizational networks and ultimately reaching to national/regional innovation systems. Fonseca [12]- building on the work of Stacey [13]- argues that innovation needs to be viewed in a much more human-centered way; conceptualized as a complex responsive process of relating between people. Lester and Piore [14] propose that the great project of developing a creative economy rests on the uniquely human capacities of rational analysis and creativity. They define these two fundamental processes as *analysis* and *interpretation* and express their concern at the increasing neglect of the latter in management strategies.

Analysis of Prior Theory and Research

Many scholars trace the introduction of innovation into the realm of economic and social change to Joseph Schumpeter's seminal work [15] *Theorie de Wirtschaftlichen Entwicklung* (*Theory of Economic Development*). Schumpeter's writing spanned a period of forty years from his undergraduate days in the University of Vienna to his term as professor of economics in Harvard [16]. According to Marz [17] he is one of the few social scientists who bequeathed an "intellectual legacy that continues to attract new generations of students teachers, scholars and politicians" (p. xv [14]). Innovation together with bank credit, according to Schumpeter, are the economic mechanisms "that define a large part of the history of mankind" [16]. In his *Theory of Economic Development* he classified innovation into five categories: new products (or goods), new methods of production (or processes), new sources of supply (or half-manufactured goods), the exploitation of new markets, and new ways to organize business. In Schumpeter's original schema, innovation is accomplished by "entrepreneurs" who developed new combinations of existing resources [18]. However, in his later works, he came to regard the large corporation as the innovative engine driving the development of leading economies [19]. His emphasis of the *entrepreneur* being a single individual changed to

viewing the concept as capable of being embodied by a collaborating team of people. In the 1940s he published his classic *Capitalism, Socialism and Democracy* which, in a salient point for contemporary economics, predicted the demise of capitalism becoming a victim of its own success [20]. McCraw [21] concludes that the history of information technology confirms Schumpeter's thinking. On the significance of the pioneer and innovator (i.e. the entrepreneur) he has this observation to make:

The pleasure derived from being creative and from pushing through sporadic innovations is the prime factor from which the acquisition of economic power is derived.

Later in his career, Schumpeter paid increasing attention to *history* "as key to understanding not only capitalism but economic life in general" (McCraw, [18] p. 248).

Fagerberg [2] makes the fundamental distinction between invention and innovation; where the former is regarded as the "first occurrence" while the latter is the "first attempt to carry it out into practice". This is in line with Van de Ven's [22] assertion that "an invention or creative idea does not become an innovation until it is implemented or institutionalized". Storey [9] concludes that the very meaning of the term innovation has been both controversial and problematical. One of the main challenges of a review of innovation is the range of definitions from a wide body of literature. In their analysis of the terms *innovation* and *innovativeness* from 21 empirical studies in the new product development (NPD) literature, Garcia *et al.* [23] discovered that "no less than fifteen constructs and at least 51 distinct scale items" were used leading to a great deal of ambiguity (p.110). The Minnesota Innovation Research Program (MIRP) resulted in important pioneering work on innovation and its publications are generally known as the Minnesota studies [8]. The MIRP program was carried out by approximately 40 researchers who conducted longitudinal studies of 14 innovations during the 1980s. Four basic factors are implicit in their work: new ideas, people, transactions and institutional context. The increasingly important role of academia in supporting innovation in knowledge-based societies has led to the development of a number of models from national systems of innovation (NIS) [24] to the more recent Triple-Helix model of university-industry-government relations [25]. The fragmentation of organizational driven innovation by the diffusion of ICT has resulted in the move towards open and user-lead innovation. Furthermore, the development of social networking and networks of practice is currently the subject of growing academic interest. Table 1 below summarises some important theoretical contributions to innovation studies described in this introductory section. However this sample is by no means exhaustive given the voluminous and eclectic nature of innovation studies.

Table 1. Some historically important contributions to innovation studies

Date	Source	Contribution
1930s	Schumpeter	Introduced the concept to social studies
1960s	Wilson	The innovation dilemma
1970s	Zaltman et al.	Contingency theory
1980s	Walton Pettigrew Van de Ven et al.	Interaction of individual, org and environment Context, content and process Minnesota studies
1990s	Slappendel	Innovation perspectives
2000s	Christensen	Disruptive Innovation
2000's	Henderson and Clark	Innovation Types
2000s	Fagerberg	Oxford handbook of innovation

In the course of his work, McInerney [26] assembled over thirty author-centric definitions of innovation from publications since 1960. These were built, like Russian dolls, from antecedent work by Rahmanseresht [27] and that of Zain [28]. A list of these innovation definitions are presented in Appendix 1. A content analysis of the innovation definitions was carried out through converting the author-centric definitions in the literature into a concept-centric format and then published [29] . This was in order to identify the most common concepts and also ones that may require further attention [30].

To summarize, prior research does not adequately encompass the innovation spectrum which can be broadly described as follows: the person as the protagonist of the innovation phenomenon; operating

in an ecological milieu spanning from immediate collaborators and organizations to national systems embedded in a cultural context. Furthermore, existing theories do not sufficiently account for the dynamic relationship between person and environment that is contingent on the flow of time and history.

Theoretical Development

Elsewhere we have proposed ecological systems theory (EST) as meta-theoretical framework for the study of innovation and information systems [31]. We have also used EST to examine a particular ecosystem–the Innovation Value Institute [32]. In this paper we will argue that EST can illuminate an historical analysis of innovation definitions in order to develop a conceptual framework to assist further work in the general innovation area. To this intent we will now introduce ecological systems theory and suggest that it provides a suitable framework for researchers to approach the topic of innovation ecosystems.

Ecological Theories: an overview

This section provides an overview of prominent ecological theories and provides a background to our argument that the framework of Urie Bronfenbrenner is most suitable to meet the present theoretical deficiencies in IS innovation research.

Firstly we will define the term ecology for the purpose of this paper. The ecological approach is normally taken as the interaction between an organism and its environment [33]. However, a recent explanation of the term in the Oxford Dictionary of English (2005) defines ecology as a branch of biology that deals with the relations of organisms *to one another* and their physical surroundings. Therefore we would like to build on this concept of the primacy of the relationship to others by offering the following definition: *an ecological approach is the study of the relations between a person and its environment and to other collaborators within the environment.*

Kurt Lewin is regarded as both the father of social psychology and of action research, and is famous for his assertion that there is nothing as practical as a good theory. He believed that a fundamental goal of researchers is to put their theories into action in order to make the world a better place to live in Lewin trained in Europe during the early years of the twentieth century and his academic formation was greatly influenced by the Gestalt movement. Gestalt psychology proposes that an organized whole is perceived as more than the sum of its parts [34]. Borrowing an analogy from physics he developed his psychological *field theory* which evolved into his conception of *ecological psychology* and this was further refined in the 1950s by his students Roger Barker and Herbert Wright [35]. Lewin argued that scientific research requires a transition from the static classifications of what he termed an *Aristotelian* paradigm to a dynamic *Galilean* paradigm. The latter examines the underlying theoretical processes which bring about the observed phenomenon [36].

J.J. Gibson was another influential theorist who introduced an ecological approach to the study of perception psychology. This arose from his work on pilot selection and the spatial challenges resulting from flying aircraft [33]. Gibson [37] proposed that the contemporary account of natural vision as a sequence of snapshots, *aperture vision*, be replaced by a dynamic perspective that took into account *ambient vision* and *ambulatory vision*. He developed his theory by considering an animal or person and their environment as an inseparable and mutual pair. Furthermore, the environment ranging from atoms to galaxies consists of structural units organized in such a way that smaller units are embedded in larger units in what he termed *nesting*. From the point of view of perception, the most important levels are the ecological levels of the habitat which can be perceived by the sense organs such as things we can “look at and feel, or smell and taste, and events we can listen to” (p. 9 [34]). *Organizational ecology* is a prominent body of theory in sociological research that examines the interactions within and between populations of organizations. Its chief apologist Michael Hannan introduced the idea in the 1970s building on evolutionary perspectives such as adaption and selection. Hannan developed his early work by engaging in the debates initiated by the influential Amos Hawley whose structural theory had launched a branch of research in the field of sociology [38]. Hawley’s emphasis on the critical role of technology-in what he termed *human ecology*- is of particular interest to this study. However after thirty years of mainly empirical work in *organizational ecology* there is a major concern with the fragmentation of research in the area. Hannan and his collaborators have recently sought to address this issue by undertaking a project of theoretical integration and unification that investigates the relationships between the distinct fragments [39]. Previous studies in

organizational ecology had utilized theories involving such concepts as “legitimation, age dependency, competition and inertia” (p. 290 [36]). Their current proposal offers deeper conceptualizations through adopting an approach based a *nonmonotonic logic,* together with *fuzzy-set theory,* which they argue, changes the fundamental theoretical core of the discipline.

Bronfenbrenner’s Ecological Systems Theory

Urie Bronfenbrenner spent most of his professional career as Professor of Human Development, Family Studies and Psychology at Cornell University. His development of Ecological Systems Theory [5] is regarded as having revolutionized studies in these areas by shattering barriers and building bridges among the social science disciplines. Previous to Bronfenbrenner’s work, the study of human development was compartmentalized among psychology, sociology, anthropology, economics and political science. However, through the concept of the ecology of human development, these disparate environments were integrated into a holistic conceptual framework of interdependent nested systems where human development was viewed as a continuum [40]. Bronfenbrenner viewed a “child’s development within the context of the system of relationships that form his or her environment” with each complex “layer” influencing the development [41]. His own conception of the theory was as “a set of nested structures, each inside the next, like a set of Russian dolls”[5]. He acknowledges the debt he owes to the theories of Kurt Lewin who expressed behavior as a function “of the interplay between person and environment” in the form of a classic equation shown below. Furthermore, Bronfenbrenner affirms that his theoretical framework originated from Lewin’s antecedent work that places behavior in context: “-situational, interpersonal, sociological, cultural, historical- and above all theoretical” [3 p 43].

$$B = f(PE)$$

Lewin’s well-known formula expresses *behavior (B)* as a combined *function (f)* of forces from within a *person (P)* and from the external *environment (E)* [35].

Bronfenbrenner argued that Lewin’s formulation did not include a time dimension and proposed his own version of the equation for the area of human development. Here, development is regarded as a function of the person interacting with the environment. This includes the effects of both constancy and change (the time dimension) on personal characteristics throughout the life span which is captured in the following equation.

$$D = f(PE)$$

Bronfenbrenner affirmed that a major motivation for his work was to provide both psychological and sociological depth to Lewin’s theories. From an IS viewpoint it is significant that he claimed his theory differed from antecedent research models in that he analyzed the environment in *systems* terms. His theory is shown diagrammatically in Figure 3.

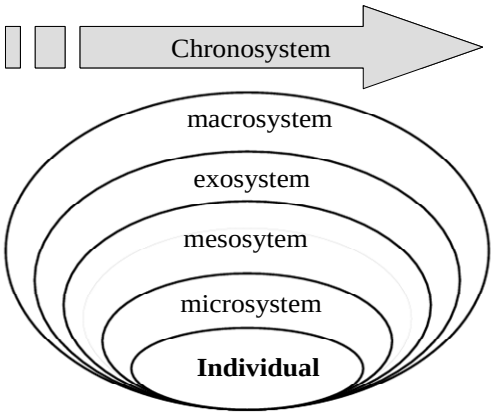

Figure 3. Ecological Systems Framework [31]

We will now firstly describe each nested layer of the modified Bronfenbrenner model where the “patterned behavior” is determined by the following:

1. Individual level: Intrapersonal factors-characteristics such as knowledge, attitudes, behavior, self-concept, skills etc. It also included the developmental history of the person.
2. Microsystem: interpersonal processes and primary groups –formal and informal social network and social support systems, including the family, work group and friendship networks.
3. Mesosystem: institutional factors –social institutions with organizational characteristics, with formal (and informal) rules and regulations for operation.
4. Exosystem: community factors-relationships among organizations, institutions, and informal networks within defined boundaries.
5. Macrosystem: public policy – local, state and national laws and policies.
6. Chronosystem: This was a later addition by Bronfenbrenner [5]. The concept "encompasses change or consistency over time not only in the characteristics of the person but also of the environment in which that person lives" [42].
7. We have presented our argument that Bronfenbrenner' theory best matches the criteria developed earlier due to its comprehensive topology, its focus on relational interactions, and its synthesis of the concepts of ecology and systems. We will now present our adaptation of the model to address two main issues: incorporation of technology and emphasizing the importance of collaboration in the IS innovation process.

Elements of an Ecological Systems Theory for IS Innovation

Based on the foregoing analysis, we will now present our framework to analyze innovation based on Bronfenbrenner's theory. The structure is based on the implicit assumption that innovation originates from the human person but is significantly influenced by interaction and interconnection with the five other layers. This contention also follows Bessant's [43] conclusion, that in dealing with the challenges of innovation; creating and reinforcing behavior patterns is the key management challenge.

We conceptualize our argument by modifying both Lewin's and Bronfenbrenner equations in a format that explicitly included the time dimension:

$$I_{(t)} = f\,(P_{(t)}\, E_{(t)}) \quad \ldots\ldots \text{Eq 1}$$

The next step is to propose a formula to capture the theoretical concept of an *EST for IS Innovation* which builds on both Lewin and Bronfenbrenner but specifically includes two extra dimensions: technology as an integral component of information systems; and the interpersonal interconnections that are essential to the innovation process. The subject of technology is not specifically addressed in Bronfenbrenner's final work. However it is alluded to via a quotation from the work of Lev Vygotsky who was influential on the development of ecological systems theory. As we pointed out earlier, theorists such as Hawley have stressed the importance of technology when seeking to understand human ecology. The relational aspect is captured in Bronfenbrenner description of the ecological *microsystem*. However we propose that the concept is explicitly included in our formulation given its importance for the innovation process which, either in the initiation stage or the implementation stage cannot be carried out in total isolation.

ISI(t) = f (P (t) R (t) E (t) T (t)) …….. Eq 2, where

ISI = information systems innovation

P = person

R= relational connections to collaborators within the innovation context

E = environment

T = technological capability

The adapted framework for IS innovation is illustrated in Figure 4.

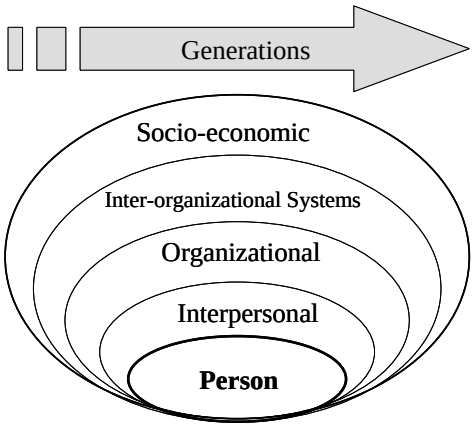

Figure 4. An Ecological Systems Framework for Innovation [32]

The revised innovation framework is now described and a small number of references are included as examples.

1. Personal Dimension: this layer includes the intrapersonal characteristics that assist or inhibit innovativeness. Development of knowledge, skills and competencies through education and training to support innovation both in terms of creative invention and of implementation are relevant here [44].
2. Interpersonal: formally this dimension will include the ability to contribute to and direct teams or work groups. Informally it will include social networks, communities of practice and personal contacts, both inside and outside the organization. Interpersonal attributes such as empathy will also be deemed relevant in this layer [45].
3. Organizational: the characteristics of the organization that the person is a member of will be significant for this layer. Culture, climate, and the management of innovation and change will influence the person's tendency to innovate [46].
4. Inter-organizational Systems: this layer will include relationship of the organization with peer organizations, academic institutions, state-sponsored support bodies [25]. The layer will also encompass formal and informal networks, clusters that support innovation, and the general area of inter-organizational systems (IOS) which is having increasing influence on business to business (B2B) and business to government relationships.
5. Socio-economic: this dimension will include innovation policy of local, regional, state and supra-national (for example the European Union), National Systems of Innovation (NSI) [24], indicators of innovation [47] and important economic theories of innovation [15].

Chronological Generations: Analogous to human development, "generations" can encompass a number of concepts. At a macro level it will take cognizance of the time dimension of the innovation environment which has been, for example, outlined in Rothwell's [48] taxonomy of innovation processes. At the organizational level this would involve assessing the innovation maturity level such as the "archetypes" of innovation proposed by Tidd *et al.* [49]. In the realm of information systems Ward *et al.* [50] developed a three era model of IS to illustrate this concept.

Implications of the Theory

Building on this antecedent body of literature, we will now summarize our argument for the adoption of ecological systems theory to examine innovation ecosystems. This approach, we argue, meets the ecological criteria outlined earlier as it:

- Addresses gaps in literature that identify the need for an ecological conceptualization of Innovation
- Provides an impetus to an important area that has stagnated due to a dearth of theory
- Adapts a theory that is highly regarded in the wider academic community: good theories are generally applicable [5, 51].
- Provides a framework that responds to the call for a more inter-disciplinary and cross-functional approach to this research area

- Firmly places the human acting person as the fundamental wellspring of the innovation process –ref Leonard [52].
- Focuses on the human aspect which can provide an impetus for the philosophical debates in ref. [53]. Invites further reflection on Lee's rejection of the “objectivist ontology” that knowledge can exist independently of knowing subjects.
- Provides guidance for practitioners e.g. strategic managers and portfolio managers, R&D managers by providing a framework to deal with the emerging Innovation Landscape
- Introduces a novel methodological approach that opens up research possibilities: the ecological experiment.
- Encompasses the dimension of time which has not significantly explored in the innovation discourse.

Now we will suggest how ecological systems theory addresses the gaps in the innovation literature outlined at the beginning of this paper [54]. The first is the *lack of clarity* as there are numerous different definitions of innovation and theoretical frameworks as outlined in Appendix 1. The second is the *lack of theoretical glue* which should be present to bind all the factors together by means of a strong underlying logic and rationale. Innovation studies are multi-dimensional and complex and have not been extensively classified in the literature. The third is the *lack of cumulative tradition* as a good concept or theory should build on existing research. The fourth is a *lack of parsimony* as there is much redundancy and duplication in the definitions of innovation. Finally there is *limited applicability* as existing theories and definitions are restricted to narrow scope conditions. We argue that ecological systems theory expands and interlinks the landscape innovation.

Discussion: A Practical Application of the Theory

Now we will outline a practical application of the theory specifically in the area of information systems illustrated using a case study of the Innovation Value Institute (www.ivi.ie). The discipline of information systems (IS) has been considered to have certain failings in its effort to impact on practice [55]. Additionally Sambamurthy and Zmud [56] noted that there is a growing gap between scholarly research and the need of practitioners. There have been numerous research studies identifying failures in IS in its attempts to achieve desired outcomes and disappointments in assessments of return on investment [57, 58]. The analyses in these studies often yield recommendations that operate at a high level of abstraction and lack the detail and specificity to lead to action-oriented solutions. Such findings, while offered in a constructive spirit of helpfulness and concern for continuous improvement, do little to advance either (i) the capability of practitioners to achieve their goals or (ii) the theoretical knowledge underpinning Information System academic research. One of the requirements for a more helpful methodology is a more systematic approach with greater sensitivity to the contextual complexity of the organizational problem-solving environment where IS practitioners work.

The development of the IT-CMF (The Information Technology Capability Maturity Framework) [59, 60] is a response to the need for a more systematic, comprehensive approach to managing IT in a manner that meets the requirements of practicing IT professionals. This research is being undertaken by the Innovation Value Institute. Applying the principles Design Science Research (DSR) [61], IT Management is being investigated using a design process with defined review stages and development activities based on the DSR guidelines advocated by Hevner *et al.* . During the design process, researchers participate together with practitioners and subject matter experts within research teams to capture the working knowledge, practices and views of key domain experts.

Developing innovative artifacts is a central activity in DSR [62] . Such artifacts can be in the form of constructs, models, methods or instantiations. For the construction of such artifacts two basic activities can be differentiated: build and evaluate where building “is the process of constructing an artifact for a specific purpose” and evaluation “is the process of determining how well the artifact performs” (p. 254 [58]). The construction of an artifact is a heuristic search process. Within this process an extensive use of theoretical contributions and research methodologies stored in the knowledge base should be made. On the one hand theoretical contributions can come from governance, value based management, risk management, compliance management, etc. to build an artifact, i.e. the situational method. The IT-CMF uses the following DSR patterns proposed in Vaishnavi & Kuechler [63].

- *Different Perspectives:* The research problem is examined from different perspectives, e.g. conceptual, strategic, organizational, technical and cultural.
- *Interdisciplinary Solution Extrapolation:* A solution or solution approach (i.e. methods, instructions, guidelines, etc.) to a problem in one discipline can be applied in or adapted to the integrated IT CMF.
- *Building Blocks:* The complex research problem of IT Management is broken into thirty three critical competencies that are examined in turn.
- *Combining Partial Solutions:* The partial solutions from the building blocks are integrated into the overall IT CMF and the inter-dependencies between the building blocks are identified and high-lighted. In order to rigorously demonstrate the utility of the developed artifact, different evaluation methods can be used. Amongst others, the “informed argument” is suggested as an appropriate evaluation method.

Conclusions

The importance, nature and philosophical underpinning of theory continue to be the subject of lively debate in the literature [53, 64, 65]. This paper addresses the need for a theoretical framework to stimulate research in the area of innovation ecosystems by building on historical analysis of innovation definitions. The work is a response to the assessment by scholars that there are significant research questions to be addressed in this important topic. The approach involved a review of antecedent models from the innovation literature. Arising from the analysis, we proposed a new theoretical lens to stimulate research in the innovation ecosystems. The result is an adaptation of Urie Bronfenbrenner’s ecological systems theory (EST) that incorporates a technological component. The EST for innovation is an important theoretical contribution because it provides a fresh perspective for academic researchers to investigate the phenomenon; and it offers an accessible conceptual structure to navigate the increasingly complex innovation ecosystem. Future work includes developing a research agenda outlining directions and themes that we hope will be profitable for researchers interested in pursuing this perennially important subject. We will conclude by quoting Schumpeter’s apologia for history towards the end of his life. For economic phenomena read innovation phenomena.

> *Nobody can understand economic phenomena without an adequate command of historical facts, an adequate amount of historical sense encapsulated in historical experience.*

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Appendix 1: Definitions of Innovation developed from McInerney (2004)