

Eurasian Studies in Business and Economics 10/1

Series Editors: Mehmet Huseyin Bilgin · Hakan Danis

Mehmet Huseyin Bilgin

Hakan Danis

Ender Demir

Ugur Can *Editors*

# Eurasian Business Perspectives

Proceedings of the 22nd Eurasia Business  
and Economics Society Conference



Springer

# **Eurasian Studies in Business and Economics 10/1**

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Mehmet Huseyin Bilgin • Hakan Danis •  
Ender Demir • Ugur Can  
Editors

# Eurasian Business Perspectives

Proceedings of the 22nd Eurasia Business  
and Economics Society Conference

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# Preface

This is the first volume (Eurasian Business Perspectives) of the tenth issue of the Springer's series *Eurasian Studies in Business and Economics*, which is the official book series of the **Eurasia Business and Economics Society** (EBES, [www.ebesweb.org](http://www.ebesweb.org)). This issue includes selected papers in the field of management presented at the 22nd EBES Conference that was held on **May 24–26, 2017** at the **Faculty of Economics of Sapienza University of Rome** in Rome, Italy, with the support of Istanbul Economic Research Association. Jonathan Batten, Giuseppe Ciccarone, Giovanni Dosi, Klaus F. Zimmermann, and Marco Vivarelli joined the conference as the keynote speakers. All accepted papers for the issue went through peer-review process and benefited from the comments made during the conference as well. In 2015, EBES Executive Board decided to honor academicians for their lifetime contributions to their fields once a year. The EBES Fellows Award is given to acknowledge a lifetime of contributions to the corresponding academic field. Contributions may be theoretical, empirical, or methodological. The recipients for the EBES Fellow Award are determined by the EBES Executive Board and the Award is given every year at the EBES Conference in May. EBES Executive Board selected **Giovanni Dosi** as the EBES Fellow Award 2017 recipient for his outstanding contribution to the fields of the economics of innovation and technological change and evolutionary theory.

During the conference, participants had many productive discussions and exchanges that contributed to the success of the conference where 265 papers by 435 colleagues from 59 countries were presented. In addition to publication opportunities in EBES journals (*Eurasian Business Review* and *Eurasian Economic Review*, which are also published by Springer), conference participants were given opportunity to submit their full papers for this Issue.

Theoretical and empirical papers in the series cover diverse areas of business, economics, and finance from many different countries, providing a valuable opportunity to researchers, professionals, and students to catch up with the most recent studies in a diverse set of fields across many countries and regions.

The aim of the EBES conferences is to bring together scientists from business, finance, and economics fields, attract original research papers, and provide them publication opportunities. Each issue of the Eurasian Studies in Business and Economics covers a wide variety of topics from business and economics and provides empirical results from many different countries and regions that are less investigated in the existing literature. The current issue (Eurasian Business Perspectives) covers fields such as:

1. Entrepreneurship and internationalization
2. Accounting
3. Human resources
4. Management
5. Tourism and marketing

Although the papers in this issue may provide empirical results for a specific country or regions, we believe that the readers would have an opportunity to catch up with the most recent studies in a diverse set of fields across many countries and regions and empirical support for the existing literature. In addition, the findings from these papers could be valid for similar economies or regions.

On behalf of the Series Editors, Volume Editors, and EBES officers, I would like to thank all presenters, participants, board members, and the keynote speakers, and we are looking forward to seeing you at the upcoming EBES conferences.

Istanbul, Turkey

Ender Demir

# Eurasia Business and Economics Society (EBES)

*EBES* is a scholarly association for scholars involved in the practice and study of economics, finance, and business worldwide. EBES was founded in 2008 with the purpose of not only promoting academic research in the field of business and economics but also encouraging the intellectual development of scholars. In spite of the term “Eurasia,” the scope should be understood in its broadest terms as having a global emphasis.

EBES aims to bring worldwide researchers and professionals together through organizing conferences and publishing academic journals and increase economics, finance, and business knowledge through academic discussions. To reach its goal, EBES benefits from its executive and advisory boards which consist of well-known academicians from all around the world. Every year, with the inclusion of new members, our executive and advisory boards became more diverse and influential. I would like to thank them for their support.

EBES conferences and journals are open to all economics, finance, and business scholars and professionals around the world. Any scholar or professional interested in economics, finance, and business is welcome to attend EBES conferences. Since 2012, EBES has been organizing three conferences every year. Since our first conference, around 9132 colleagues from 92 different countries have joined our conferences and 5240 academic papers have been presented. Also, in a very short period of time, *EBES has reached 1713 members from 84 countries.*

Since 2011, EBES has been publishing two academic journals. One of those journals, *Eurasian Business Review—EABR*, is in the fields of industry and business, and the other one, *Eurasian Economic Review—EAER*, is in the fields of economics and finance. Both journals are published thrice a year, and we are committed to having both journals included in SSCI as soon as possible. Both journals have been published by *Springer* since 2014 and are currently indexed in *Scopus*, the *Emerging Sources Citation Index* (Thomson Reuters), *EconLit*, *Google Scholar*, *EBSCO*, *ProQuest*, *ABI/INFORM*, *Business Source*, *International Bibliography of the Social Sciences (IBSS)*, *OCLC*, *Research Papers in Economics (RePEc)*, *Summon by ProQuest*, and *TOC Premier*.



Furthermore, since 2014 Springer has started to publish a new conference proceedings series (*Eurasian Studies in Business and Economics*) which includes selected papers from the EBES conferences. Also, the 10th, 11th, 12th, 13th, 14th, 15th, and 17th EBES Conference Proceedings have already been accepted for inclusion in the Thomson Reuters' *Conference Proceedings Citation Index*. The 16th, 18th, and subsequent conference proceedings are in progress.

On behalf of the EBES officers, I sincerely thank you for your participation and look forward to seeing you at our future conferences. In order to improve our future conferences, we welcome your comments and suggestions. Our success is only possible with your valuable feedback and support.

With my very best wishes,

Jonathan Batten, PhD  
President

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**Part I**  
**Entrepreneurship and Internationalization**

# From Entrepreneurial Orientation to Innovation: The Mediating Role of Information System—Case of Tunisian SMEs



Samah Chemli Horchani and Mahmoud Zouaoui

**Abstract** The object of the entrepreneur passes necessarily through the development of an entrepreneurship shared by all. The achievement of this object supports the introduction of an information system mobilizing technology impregnate by the environment in which the business operates. The objective of this study is to present a state of the literature on entrepreneurship, innovation and information systems. Therefore, we propose a conceptual model on entrepreneurship-innovation link. To provide more information, empirical investigation covering two cases of Tunisian SMEs. The observatory study, conducted through internships in companies, allowed us to see the evolution of the model after 30 years of operation. The analysis reveals important interactions between the various components of the proposed model. Overall, the study will provide relevant knowledge about the impact of entrepreneurial orientation on innovation, in particular through the information system.

**Keywords** Entrepreneurial orientation · Radical innovation · Incremental innovation · Information system · Environment

## 1 Introduction

Radical innovation and incremental innovation have been the subject of several controversies concerning the conditions and mobilized tools leading to the implementation of an innovative business project. The importance is given to entrepreneurial guidance to help businesses to grow especially in a knowledge intensive environment (Astebro et al. 2013). Indeed, innovation and entrepreneurship are seen as connected so that the understanding of the first concept necessarily involves the understanding of the second (Schumpeter 1954). By result, entrepreneurship will enable a better understanding of the innovation dynamic's (Stolper 1994). Several researchers started to explore the significant determinants driving the degree of

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innovation and intensity (Stephan 2014). Attention is then drawn to the entrepreneur as the personification of innovation (Hagedoorn 1996). Claims are increasing restoring value to the “Man entrepreneur”, which is the most exciting dimension but also the most difficult to master. The variety of characters and persuasions makes difficult the existence of a portrait type of entrepreneur. However, it would be possible to say that the entrepreneur is a person who does not behave in a traditional way view. He operates in an uncertain environment (McClelland 1972) where the Information Technology and Communication (ICT) reinforce this reality. Technology has long been considered the only determinant of the organization prosperity. However, technological imperialism is long gone, and technology substitution to human intelligence is quickly fallen. The impact of information technology on organizations emerges through complex interactions between technologies and actors. The technologies have also become a component enhancing organizational capital of the company. It is no longer possible to evaluate and study the technological performance by separating the human factor. Entrepreneurial orientation (EO) would be the magic hand giving the firm’s ability to innovate. The entrepreneur must seek the necessary improvements to ensure the viability of his business. His way of directing seems to be decisive.

In this study, we examine the relationship between entrepreneurial orientation and innovation through the information system. The study investigates the effect of the perception of the environment by the information system on the intensity of innovation. Our empirical part focuses on the study of two cases (E1) and (E2) of small and medium enterprises (SMEs) in Tunisia. In the first case, the company will operate a radical innovation with “the father-son recovery” in order to pursue new opportunities while the second operates in continuous incremental innovations to address the environmental turbulence. We will try to make a comparative study between the two cases at the end to identify and better understand the reasons which led the two companies to process differently to changing environmental.

Indeed, the study choice results from the fact that research on entrepreneurship and innovation deal with questions of different roles played by small and large entrepreneurial firms (Hagedoorn 1996). Our goals are first to broaden the scope of study of entrepreneurship and innovation. Consequently, we will build and validate a conceptual model on entrepreneurship-innovation link. Research will acquire available relevant knowledge to SMEs about the impact of entrepreneurial orientation on innovation, in particular through the information system.

## 2 Theoretical Background and Hypothesis Development

The questioning of the link between entrepreneurship and innovation through the information system is positioned by treating three essential components that are entrepreneurship, innovation and the information system. The study uses several theoretical fields such as resource-based theory (Roy 2010), the theory of organizational learning (Kim 1993; Leroy and Ramanantsoa 1997) the theory of knowledge

**Table 1** The paradigms of entrepreneurship

Paradigms	Authors	Principles	Interests
The business opportunity	Shane and Venkataraman (2000)	Identify and exploit opportunities.	Detection, evaluation and exploitation of sources of opportunities and individuals who discovers these opportunities.
The creation of an organization	Gartner (1990)	Create an organization by one or many persons.	Researchers are pushing the paradigm of the organization creation to the strategic organization development and even the transformation of business (Puhakka 2010).
Value creation	Bruyat and Julien (2001)	Create individual economic or social value.	The growth.
Innovation	Druker (1985) and Julien and Marchesnay (1996)	Critical importance of innovation in the definition of entrepreneurship.	The different forms of innovation.

Source: Based on Janssen (2009)

creation (Nonaka and Konno 1998), the contingency theory (Boyer and Freyssenet 2000) the theory of evolution (Schumpeter and Perroux 2008). The tangle of several theories gives a rich mosaic of well-established concepts studied.

## 2.1 Entrepreneurial Orientation

The heterogeneity of the entrepreneurship field has not stopped researching classification attempts paradigms (Fayolle and Verstraete 2005). The distinction is made between four primary paradigms and which are summarized in Table 1.

Note that dominance is attributed to the search for a type or an ideal that leads to performance (Randerson and Fayolle 2010). The concept of entrepreneurial orientation was introduced by Miller (1983) defending the importance of the leader personality and his leadership in the organization. Leaders have an indispensable role on taking the organization to the achievement of performance. It is defined as strategic direction giving a specific aspect decisions and practices (Lumpkin and Dess 1996). The (EO) represents the processes, practices, and activities related to decision making that leads to organizational entrepreneurship (Covin and Slevin 1989). It is the ability of the organization to be leaders technologically, and its propensity to be proactive (Covin and Slevin 1991; Zahra and Covin 1995). It evokes the strength to pursue the opportunities and initiate innovations (Randerson and Fayolle 2010).

In the literature, five dimensions are attributed to the entrepreneurial orientation are the innovativeness, proactivity, risk taking, aggression towards the competition and autonomy (Miller 1983; Lumpkin and Dess 2001). The innovativeness

represents the tendency to engage and support a novelty (Lumpkin and Dess 1996). Risk-taking indicates the determination to use resources in strategies or uncertain projects (Zahra and Covin 1995). Proactivity is a replica of a business in attractive market opportunities (Lumpkin and Dess 1996). Competitive aggressiveness implies the willingness to retract instantly and eagerly competitors (Lumpkin and Dess 1996). Autonomy is the ability to make self-management measures in monitoring the market opportunities (Lumpkin and Dess 1996).

## 2.2 *Innovation*

The analysis of key inputs on innovation shows that research has overridden the macroeconomic towards research-oriented company (Bhupatiraju et al. 2012). Schumpeter (1936) explains innovation as economic activity that changes the production function. They are driving developments. Crozier (1970) says innovation is triggered within an organization following a crisis. It reflects the choice of actors. This requires interventions on men and on organizational structures to introduce novelty into the culture of the company to act with the system. This requires “a relational, institutional breakdown, no mutual adjustment but initiatives and human leadership, learning processes necessary to the individual players responsibility (Crozier and Friedberg 1977). It reflects a situation in which a company manages to boost its sector to influence the structure and to convert the features to its privilege; it is a strategic intent, entrepreneurial ambition, a will to build the future (Roy 2010). Innovation has a new connotation. It is obtained by reversing an established arrangement and taking financial risks, rejection or indifference. It is synonymous with originality (Barreyre 1980). Thus innovation can be through the creation of a product, service or process (Tushman and Nadler 1986). Innovation can also implies the adoption of a new idea (Damanpour 1991). In any case, innovation must be evaluated in relation to the company where innovation is adopted (Johannessen et al. 2001). Innovation can also manifest itself in the market introduction of a novelty (Hermann et al. 2007). Therefore, it is the culmination of a whole construction process of trial and error, improvement to obtain an output (Corbel 2009). Several types of innovations have been made at past research. We have chosen to make a classification of innovation introduced by changing the intensity. The distinction is made between radical or significant innovation, and incremental or progressive innovation. Radical innovation is to break with the -clefs factors of environmental success in order to try to impose its own rules which create an imbalance in the market, resulting in this way a change of reference and mounted new competitors (Dumoulin and Simon 2005). The company is located in front of the obligation to change its field of activity and sometimes its trajectory and evolution. It is a creative destruction (Schumpeter 1936). According Pin et al. (2003), three approaches are being considered to make a break. The first is reactive, in which the firm develops a disruptive strategy to have the ability to survive in its environment. The second is a proactive approach that gives the company the

**Table 2** New approaches to innovation

Theories	Authors	Contributions
Evolutionary theory	Schumpeter (1936), Nelson and Winter (1982)	The cognitive process is central to innovate and it is manifested through the routines and knowledge.
The resource-based theory	Barney (1991), Le Bars Anne (2001), Warnier (2003)	Companies can be distinguished by the possession of scarce resources which are sources of benefits competitive. Innovation results from a new combination of resources while preserving the business environment balance.
The competencies theory	Durand (2000)	Need for resources associated with cognitive processes in order to ensure coordination and interaction between the tangible resources (technology, equipment) and intangible resources (routines, knowledge, knowledge information)

possibility to change the environment in which it operates. The third is the synchronic harmonization of the two approaches. The firm adapts while possessing the ability to change the environment. The risk in this type of innovation is important as radical innovation requires significant investment and time.

Incremental innovations are continuous improvements of existing products or processes (Tarondeau 1994) by organizational learning, without requiring new doing-knowledge (Broustail and Fréry 1993). The risks of incremental innovation are limited. In the new approaches (resource based approaches, evolutionary theory, the competencies approaches) innovation is a set of combined resources (knowledge, skills, abilities) but also processes (Durand 2000). The main contributions are summarized in Table 2.

Routines are a knowledge acquired through repetitive actions, coordinating knowledge and individual skills (Coriat and Weinstein 1999) and the result of collective learning (Mack 1995). Knowledge is the source of distinction as they result from the unique history of each company (Karray-Driss 2001). The existence of a cognitive process will ensure organizational coordination (Durand 2000). These processes are manifested in the form of competences which are summarized in Table 3:

The literature review brings up, technology and management systems as key competence for company. The information systems are seen as a management tool for the conduct of the organization. They have several archetypes of use (Reix 2004). The information system is a source of competitive advantage (Ross et al. 1996). These systems leverage other intangible and complementary sources such as humans and business to acquire competitive advantages (Powell and Dent-Micallef 1997).

This idea was further developed in the theory of dynamic capabilities focusing on the firm provision to integrate, build and reconfigure its powers to deal with swift changes in the environment. Capacity is the work of an entrepreneurial desire to learn and cope with the changing environment and changing it (Tarondeau 1998). What would be the location of information systems as an object to be managed and a

**Table 3** The business competences

Authors	Competences
Meyer and Utterback (1992)	Research and development Production and manufacturing Market
Barton (1992)	Learning and knowledge of employees Technological system Management system Value Company's system
Fowler et al. (2000)	Technological Market orientation Integrative
Spanos and Lioukas (2001)	Organizational Sale Techniques
Daneels (2002)	Technological Consumers
Wang et al. (2004)	Marketing Technological Integrative

management tool? Will we have the opportunity to squeeze between the entrepreneurial orientation and innovation?

### 2.3 The Information System

The information system is defined as a set of formal processes of capturing, treatment, storage and communication, based on technological tools, which provide support to transactional and decision making, as well as communication processes driven by corporate actors, individuals or groups of individuals in one or several organization (Kalika and Kefi 2004).

Thus, an information system has several dimensions:

- First an informational dimension. Indeed, the SI provides information to users. To be employable information must be translated into signals accessible to the senses, which leads to build an image of the real world (Kalika and Kefi 2004). This image or representation are the safe keepers of information, communication and the realization of models or concepts.
- Then the technological dimension of the information system representing the used tools such as the computer or software. These tools ensures the capture, transmission, storage, processing and retrieval of data in a communicable form (Reix 2004). The last dimension is an organizational dimension by facilitating the flow of work processes and providing more flexibility in the structure.

### 3 Proposed Conceptual Model

After review of the literature, the question then concerns the relationship between entrepreneurial orientation and innovation through the information system? To answer this question, we developed three key assumptions:

**H<sub>1</sub>** : Entrepreneurial orientation has a positive impact on the information system.

Information systems as new technology, new daily carry endings. They thus represent sources of opportunities ensuring the development of new activities (Janssen 2009). The contractor, going in search of opportunities, must enjoy. The use of technology reveals two main aspects that are the “artifact” aspect, also said hardware/software, and the “use” aspect, showing how to use the technology in the different situations they meet (Orlikowski 2000). From this, the establishment of an information system must be accompanied by a strong involvement of the entrepreneur must be in constant contact with his staff and should explain what is expected of them on the use and behavior to have vis-à-vis these newly introduced technologies in the organization (Haines and Petit 1997). However, contractor’s behavior is influenced by, first of situational factors (current environment) and secondly, by intrinsic factors personalities and individual stories (Bartoli et al. 1989). Representations, designs and developed strategies will then be influenced. Similarly, users who receive more support from their supervisors to use the system are more likely to be more satisfied and use it in a wide field (Haines and Petit 1997). The entrepreneur must have the conviction and the necessary involvement to end to encourage and supervise its business members. Therefore, the communication within an organization and information systems, as new technology, bring daily new endings. They represent sources of opportunities ensuring the development of new activities (Janssen 2009). The entrepreneur, going in search of opportunities, must enjoy it. The use of technology reveals two main aspects that are the aspect “artifact”, also said hardware/software, and the “use” aspect, showing how to use the technology in different situations encountered (Orlikowski 2000). From this, the establishment of a system information must be accompanied by a strong involvement of the entrepreneur, who must be in constant contact with his staff and who have to explain what is expected of them on the use and behavior to have vis-à-vis of these newly introduced technologies in the organization (Haines and Petit 1997). However, entrepreneur’s behavior is influenced by, firstly, the situational factors (current environment) and secondly, by intrinsic factors like personalities and individual stories (Bartoli et al. 1989).

Representations, conceptions of each individual as well as the strategies developed will then be influenced. Similarly, users who receive more support from their supervisors to use the system are more likely to be more satisfied and use it in a wide field (Haines and Petit 1997). The entrepreneur must have the conviction and the necessary involvement to end to encourage and supervise its business members. Therefore, the communication within an organization becomes an imperative favoring the establishment of information systems (Flynn and Foster 1984). The



implementation of the information system becomes a project require the explicit approval of the entrepreneur (Powell and Dent-Micallef 1998). Entrepreneurial orientation also means taking risks facing the uncertainty. Indeed “Decisions marking the strategic situations have, by definition, a large degree of uncertainty, to the extent that the available information is either partial or too numerous, ambiguous, biased or impossible to obtain because it key to the future and must consider other (Puthod 1998). Identifying the informational utility allows decision makers to customize the information that will be their advantage, and so have appropriate information (Ammar 2003). The entrepreneur aim to develop information systems that are compatible with their activities and that facilitate their daily lives.

**H<sub>2</sub>** : The information system has a positive impact on innovation.

Two levels can be presented. The first level is located within the company. The information system facilitates communication and vertical/horizontal coordination (Fulk and De Sanctis 1995). This encourages collaboration and information sharing between the members of the organization. Different stakeholders can work at the same time, it is concurrent engineering, with interactions continue (Davidow and Malone 1992) which support the design of new products or the absorption of new procedures. Then, the information systems undertake a high correlation among workstations, greater communication collateral, less hierarchy, and greater flexibility in the ability to respond to market changes.

The second level is outside the company. In fact, the uncertainty related to the context of innovation requires anticipating customer needs and prediction of actions and reactions of competitors. Having the sources of information at the right time, effective treatment with appropriate tools and adequate transmission in the business can reduce uncertainty and encourage the development of innovation (Janssen 2009). Information systems then offer well-developed databases, which reduces the response time to market changes and the environment (Ammar 2003).

**H<sub>3</sub>** : The information system has a mediating role between the EO and innovation.

When the entrepreneur makes the decision to innovate, each step coincides with a particular need for certain types of information (Lebraty 2002). Thus, for the initiation phase of defining the problems or opportunities, it requires information to ensure the measurement and comparison of the company performance given the environment that influences its behavior. The design phase requires information that will enable a causal analysis of the situation determinants especially those over which the company has the ability to act. The selection phase uses information forecasts and estimates for assessing the consequences of each of feasible actions. The implementation phase requires, again, indicators and measuring performance achievements.

The Link between entrepreneurial orientation and innovation through information systems ensures the involvement of the organization members in the establishment process and innovation development. Information systems can be used as differentiation tools by providing strategic and organizational opportunities that did not exist before. Learning through the use of technology may result in cognitive evolution

facilitating strategic choices often depend on dynamic capabilities inherited from the past trajectory (Teece 1998).

## 4 Research Methodology

In the preliminary field work, a synthesis of knowledge on entrepreneurial orientation, innovation and the information system was carried out on the basis of the available literature. This synthesis has enlightened us on the fact that entrepreneurial orientation, innovation and the information system are broad concepts and difficult to view measured they acquire their specificity in the company or they develop. For this reason, we opted for an observatory study. But reliability in qualitative research depends on the researcher's ability to soak up the field of the study and to return it.

As a result, we were among the companies studied and we observed the actants in their relationship with information technology and in everyday life. Our presence in offices and workplaces has allowed us to see the entrepreneurs in their immediate environment, to see the style of communication with their staff; this was a mine of information and gave us access context. Our observation was made in two important steps through internships in the companies studied separated in time. In the second stage, data collection was made from a trilogy in the method; we conducted interviews, made observations and conducted a literature review (De La Ville 2000).

We can qualify our discussions as semi-structured guided. We conducted semi-structured interviews using an interview guide containing open questions related to the themes of our research and questions of the interview guide were put to the respondent (Roussel and Wacheux 2005). The document used is collected on the workplace but also through the Internet. This triangulation of different resorting to various means (observation, interviews, documentation) and aimed to enhance the reliability and internal validity of the results (Miles and Huberman 2003). We made an intra-site analysis to study each case in depth, and in its particular context. Then we proceed to go back and forth between the case and theoretical frameworks offering a comparison of the explanatory power of conceptual grids, to develop a critical approach and refine the theoretical sensitivity according to the observed results.

## 5 Results

The Tunisian economy is based on SMEs; the study examined two cases of SMEs working in the textile sector.

In the first observation period, the environments in which companies are obliged stewardship and associated experience daily the developments at the operation level. The information and business intelligence often go together and sometimes merge in search of corporate interests. They consist of the basic elements and essential

stimulants in decision making and implementation of various business activities. Entrepreneurs, personally, make periodic visits to customers and detect their impressions on products. Then Informal information is formed by rumors or discreet and unpublished news. It can postpone the closure of a business, the extension of another, the arrival of sophisticated and more productive equipment that we want to avoid propaganda. Once the information gathered, they will be sorted in order to identify useful information. This information will provide vital support to make decisions about how much to produce the quantities to stoker, products designs, markets to exploit price changes. In other words, information lights the ways to follow in the short term and the long term. This Approach may change at any time during the get new information that requires action or rapid response. In this context, the head of (E1) states that the size of the company makes its flexibility and rapid adaptation to its environment. They ask their opinion on new market trends and new models. With the information and business intelligence, the entrepreneurs- managers have acquired valuable experience that allows them to avoid past mistakes and to see more clearly in business. Both companies have no specialized service in information, but all members of the undertaking to integrate and intervene in the search for information. They become both sources and information officers. Such behavior assists all their actions and decisions. Two types of information are detected in both cases. Firstly the formal information that comes from suppliers of equipment and raw materials, sister organizations, the media.

Then, we have the informal information under rumors or discrete and unpublished news. They can postpone the closure of a business, the extension of another, the arrival of sophisticated and more productive equipment that we want to avoid propaganda. Once the information gathered, they will be sorted in order to identify useful information. This information will provide vital support to make decisions about how much to produce the quantities to stoker, products designs, markets to exploit price changes. In other words, the path to follow in the short and long term will be described. This Approach may change at any time during the get new information that requires action or rapid response. In this context, the head of (E1) states that the size of the company makes its flexibility and rapid adaptation to its environment.

In both cases the entrepreneurial orientation is provided by the founder-director. In the first case (E1), the leader conducts work planning while setting short-term and long-term goals. However, it should be noted that the plans are not rigid and are affected by several internal and external factors. For internal factors, it should be noted that the contractor and staff cooperate to ensure the prosperity of their undertaking. In this context, it is essential to stress the importance of the entrepreneur qualities. The latter is in contact with employees who are not only sources of information, but also innovative ideas for improving work flow and product flow. For external factors, the leader tries to have a realistic view of the future of his business. This vision is reflected in the direction to be taken using available information. The activity in (E1) revolves around the leader representing the Company's core. He plays the role of father ensuring that handles these workers in their travails and directs them to the right path.

In the case (E2), entrepreneurial orientation manifests itself daily. Planning for the long term is absent, which may be related to the market and the fashion phenomenon that changes with the seasons and changes with changing consumer tastes. These changes are imposed on employees who have to adapt without the need to give their opinions. Contact with the entrepreneur remains easy but there is a strong centralization of power at the level of management. The leader retained his role as a father giving advice and orders to its employees to direct. Innovations are incremental. They manifest their self's in response to the needs of demand.

The second period of observation is made after the revolution. Note that during this period many companies have suffered from the socio-economic instability that prevailed in the country. We looked at two cases studied previously. For (E2), there has been an increase in the size of the company and a change in the local; the activity also expands and found a passage in the script set to subcontracting. However, the leader claims the conditions of work, funding problems and the risk of losing customers subcontractors. It operates continuously innovations in the production process while claiming employee resistance.

According to the leader of (E2) radical innovations are not possible at least because of their high costs but also because of the lack of a model creation unit in its company. Innovation is done continuously in response to the environment. For (E1), contact with the officer was surprising us. Indeed, following the rapid changes those have affected the Tunisian market, the manager decided to stop its activity because the market is no longer profit-bringer.

That decision coincided with the appearance of the company of his son. Indeed, after the field investigation, it has been found that in this case, the contractor has made a technological breakthrough by selling the old machine and the purchase of new equipment for the new son-activity, a legal break by changing the company name and finally a commercial break by the change of the industry and the market target.

This observation has allowed us to open the insertion path of takeover entrepreneurship in the field of entrepreneurship (Boumedjaoud 2016). The transferor- father did enjoy the son- buyer of his experience and all his cognitive, physical and financial capacity to support the new business. In this sense, the research put the emphasis on the transferor and its ability to mourn his company (Bah 2009). A new company has newly born crawling with the past and pursuing new opportunities.

## 6 Conclusion

We can see that The EO leads to different types of innovation and this is through different perceptions and information systems. The father's support is indispensable in the development of his son's business. More questions can then be asked about the role of the intellectual and financial capital transfer in family businesses. It would be possible to see that: When we speak about EO and Innovation, the prospects have to be open to make a choice supporting a new development. The freedom of adjustment

of means, the satisfaction of the stakeholders and the viability of the company are the key components of a rigorous management and carrying a bearer of a fruitful future. A spark spouts out at the time of the contact between the company and its environment injecting a magic of rebirth for the company: “The rupture” which is essential keep the doors open to a rich future of promises.

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# Complexity Theory in the Advancement of Entrepreneurship Ecosystem Research: Future Research Directions



Zeynab Aeeni and Mehrzad Saeedikiya

**Abstract** The underlying principles of complexity theory has been disused in “five dimensions of non-linear interactions between agents and components”, “hierarchical nature of the system”, “emergence”, “co-evolutionary order creation”, and “self-organization”. The rationale for considering entrepreneurship ecosystem as a complex system has been presented. Then, the application of complexity theory for the study of entrepreneurship ecosystem and future research directions have been comprehensively discussed. The paper contributes to the entrepreneurship research with its emphasis on the application of complexity theory as a new line of reasoning for the study of entrepreneurial ecosystems.

**Keywords** Entrepreneurship ecosystem · Complexity theory · Complex system

## 1 Introduction

Entrepreneurship is a phenomenon that occurs in a process (Bygrave and Hofer 1991) and many factors and actors are involved in its realization (Stam 2015; Mason and Brown 2014; Neck et al. 2004; Van de Van 1993). However, many previous research have discretely studied the actions of the agents, events, or organizations alone. It must be admitted that the realization of the entrepreneurial process depends on actors and several factors; thus, it does not seem logical to study each of them as a separate identity independent of other factors (Neck et al. 2004). The improvement of entrepreneurship depends on processes that govern the interaction between these factors and actors (Vogel and Fischler-Strasak 2014). Such a requirement has led to the formation of a new approach in the field of entrepreneurship which is called

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entrepreneurship ecosystem. Entrepreneurship ecosystem is collection of entrepreneurial activities and resources that result in a productive entrepreneurial dynamic in a region or country (Acs et al. 2015). In other words, entrepreneurship ecosystem is a new and distinct approach which puts an emphasis on collaboration between lots of elements involved in entrepreneurship which in the past had independently and separately been examined in the literature (Mason and Brown 2014). It covers a set of different interdependent and interconnected actors and factors within a certain territory (Kantis and Federico 2012; Mason and Brown 2014; Stam 2015; Vogel and Fischler-Strasak 2014) that must fit in their proper places in the ecosystem to result in an entrepreneurial activity (Neck et al. 2004). Based on this approach, the entrepreneurial process and entrepreneurship ecosystem where it takes place in simultaneously feed and support each other and are interdependent (Neck et al. 2004; Cohen 2006). In fact, the ecosystem approach provides a framework for reviewing the interaction and communication between people and their environment and it refers to a combination of factors that play a role in entrepreneurship development (Pereverzeva 2015).

The history and empirical and theoretical foundations of entrepreneurship ecosystem approach dates back to recent years. Moreover, the literature on entrepreneurship ecosystem is rather shallow and is still in its early stages so that previous research is mostly empirical and descriptive. They mainly provide a list of relevant factors without a clear argument on causal relations between the factors; in addition, they present no clear explanation of interaction between the proposed factors and entrepreneurship (Stam 2015). In fact, the realm of research on the entrepreneurship ecosystem is still in its infancy and faced with vacuum in theorizing. In order to develop this field of research it is necessary to make considerable theoretical efforts so that to put forward theories that will provide a basis for many subsequent experimental works.

In order to fill this gap, this paper aims to propose a reliable theoretical basis to be used for determination of paths for future research with a focus on theory building in the field of on entrepreneurship ecosystem and related topics and variables. Because of the richness of complexity theory, it has had a theoretical contribution in a wide range of scientific fields. The interdisciplinary nature of complexity theory can be verified by observing the footprints of the theory in the realm of natural, social, and artificial ecosystems (Frenken 2006). Hence, despite overlooking complexity theory in the realm of entrepreneurship ecosystem, complexity science in general and complexity theory in particular can propose remarkable insights for understanding this phenomenon and enriching related research.

In view of that, in this study we propose complexity theory as a theoretical basis for research on entrepreneurship ecosystem so that it can resolve major shortcomings in current research and clarify the direction and paths for future research. Making an allowance for this theory, we explain the research paths for further theoretical works in the field of entrepreneurial ecosystem. In addition, we also suggest further research topics that can fill the gaps in existing literature.

Accordingly, the rest of the paper is organized as follows. In the next part, we discuss the current situation of entrepreneurship ecosystem research highlighting the

most important available studies and their main focus. In the third part, we explain the complexity theory and complex systems and review their most important features. In the fourth part, we briefly address the status of the complexity theory in entrepreneurship research and summarize the main studies in this area. In the fifth part, the logic for the utilization of complexity theory as a theoretical basis of the entrepreneurship ecosystem research and the directions for future research will be presented.

## **2 Entrepreneurship Ecosystem Research, the Current Situation**

Most of previous research in the field of entrepreneurship that are focused on entrepreneurs has overlooked the historical and gradual evolution and actions of actors and even neglected several factors behind the creation of entrepreneurial infrastructure (Neck et al. 2004). Recent research on entrepreneurship suggests that entrepreneurship is a difficult and multi-dimensional and multilevel phenomenon and in order to enhance this phenomenon it is necessary to consider dynamic processes which describe the interaction between multiple external factors, regional and local conditions, and the entrepreneurs or innovators (Vogel and Fischler-Strasak 2014). This approach aims to stress the importance of social and environmental factors that are beyond the control of individuals (The Government of India, Planning Commission 2012). Based on the underlying assumption of this approach, the performance of launched businesses is influenced by the factors other than the business itself, in other words it is affected by the ecosystem that surrounds the business (Fuerlinger et al. 2015). The quality of the entrepreneurship ecosystem affects not only the entrepreneurs and their businesses, but also the overall national entrepreneurial performance and their level of novelty (Manimala et al. 2015). Entrepreneurship ecosystem not only acts as a catalyst for accelerating economic development in communities with static economies but also it could serve as a major provocative factor for economies undergoing decline and stagnation (The Government of India, Planning Commission 2012).

The common point shared between entrepreneurship ecosystem and other similar typologies such as clusters, industrial zones, innovation system is their emphasis on the external business environment. Moreover, the focus on the entrepreneur is the point which makes a distinction between these concepts and the entrepreneurship ecosystem. Compared to its similar typologies, entrepreneurship ecosystem approach not only considers entrepreneurship as the outcome of a system but also does not neglect the importance of entrepreneurs as one of the key players in creating and maintaining the health and survival of the system (Stam 2015). Most definitions proposed for entrepreneurship ecosystem are suggesting interconnections between economic agents and imply the fact that their success and survival are dependent to each other (Mason and Brown 2014). In other words, entrepreneurship ecosystem is

considered as a set of interdependent elements and actors that are formed with the following aims: creating new business ventures (Van de Van 1993; Vogel and Fischler-Strasak 2014), achieving sustainable development through the formation of new stable businesses (Cohen 2006), creating wealth and economic prosperity (Prahalad 2005), developing a platform for the alliance of entrepreneurial actors (Mason and Brown 2014), and enabling a productive entrepreneurship (Stam 2015).

Because of the importance of the ecosystem approach in the field of entrepreneurship research, in recent years many studies have been conducted on various related topics. The first studies of entrepreneurship ecosystem can be traced in the work of Neck et al. (2004). After that, Cohen (2006) made an effort to propose a typological framework for investigating the interaction between multiple components existing in entrepreneurship ecosystem. Later, other scholars sought to introduce some frameworks and models for entrepreneurship ecosystem (such as Neck et al. 2004; Isenberg 2011; Suresh and Ramraj 2012; Foster and Shimizu 2013; Stam 2015). Other researchers also conducted research on other related topics such as components and dimensions of entrepreneurship ecosystem (Bernardez and Mead 2009; Vogel and Fischler-Strasak 2014; Kline et al. 2014; Mason and Brown 2014), identifying factors affecting the formation of entrepreneurship ecosystem (Cohen 2006; Arruda et al. 2013), types of entrepreneurship ecosystem (Bernardez and Mead 2009), role of policies in shaping the ecosystem (Kantis and Federico 2012; Fuerlinger et al. 2015), key factors involved in the success or failure of entrepreneurship ecosystem (Vogel and Fischler-Strasak 2014; Kshetri 2014; Pereverzeva 2015), and indices for measuring the entrepreneurship ecosystem performance (Acs et al. 2014). Table 1 summarizes these research efforts as well as their focus area.

It is worthy to mention some key points regarding to the entrepreneurial ecosystem literature. First, many of these studies overlap. A part of the literature which aimed to provide a model or framework for entrepreneurship ecosystem has merely presented the dimensions and components of the ecosystem. These components and factors are mostly repeated in ecosystem literature. Second, as stated by Stam (2015)

**Table 1** Entrepreneurship ecosystem literature and their focal points

Focus	Authors
Frameworks and models for entrepreneurship ecosystem	Neck et al. (2004), Isenberg (2011), Foster and Shimizu (2013), Stam (2015)
Components and dimensions of entrepreneurship ecosystem	Fetters et al. (2010), Vogel and Fischler-Strasak (2014), Kline et al. (2014), Mason and Brown (2014)
Factors affecting the formation of entrepreneurship ecosystem	Cohen (2006), Arruda et al. (2013)
Types of ecosystems	Bernardez and Mead (2009)
Role of policies in shaping the ecosystem	Kantis and Federico (2012), Fuerlinger et al. (2015)
Key factors involved in the success or failure of entrepreneurship ecosystem	Vogel and Fischler-Strasak (2014), Kshetri (2014), Pereverzeva (2015)
Indices for measuring the performance of entrepreneurship ecosystem	Acs et al. (2014)

most studies are descriptive and experimental and as a result, a little significant theoretical contribution is observable in the majority of research. Third, the current state of entrepreneurship ecosystem research lacks a rigorous and holistic theory and this keeps the domain under the dominance of the fragmented and islandic theories applicable to study the components of the ecosystem separately not suitable for studying it as a whole. Therefore, we are still faced with many unanswered questions especially in theoretical side about the relationship between the components of ecosystems and their interaction mechanism in entrepreneurship, the importance of various components in the ecosystem, explanation of the formation and evolution of ecosystems over time, etc. We hold that to be more efficient, entrepreneurship ecosystem research has to not only expand in theoretical aspects but, to build on a more holistic and comprehensive theoretical grounds.

As mentioned earlier, in this study we suggest applying complexity theory as a theoretical basis i.e. we show how complexity theory is consistent with the ecosystem approach in general and entrepreneurship ecosystem in particular to enhance the theoretical grounds. Accordingly, the following section discusses the main features of complex systems and complexity theory.

### **3 Complex Systems and Complexity Theory**

The history of complexity studies in the fields of physical and biological sciences dates back to the 1950s (Fuller et al. 2008; Wu and David 2002). But after the introduction of the open systems approach to organizations in the 1960s, complexity has become one of the key concepts of the studies in the literature conducted on organizations (Anderson 1999). The theory and methodology derived from this paradigm was also utilized in the realm of social sciences (Wu and David 2002) and in the last two decades it has increasingly been used in studies of organizations (Swanson and Zhang 2011). Therefore, complexity itself is based on the general theory of systems by von Bertalanffy (1968). Nevertheless, listing more features for systems and putting emphasis on relationships and interdependencies between components of a system enriched general systems theory (GST) (Phelan 1999; Peltoniemi and Vuori 2004). Concerning this subject, Phelan (1999) asserts that complexity theory is different from systems theory in terms of the subject, technique, and epistemology. According to Peltoniemi (2006), there are three characteristics which have a close relationship with the key elements of complexity theory and they are: exploratory analysis, agent-based modeling, and complexity arising from the interaction of actors. According to Phelan (1999), the subject of complexity theory is exploratory. As a result, complexity theory provides theoretical lenses for analyzing complex interdependencies in a complex and pluralistic world i.e. a world in which determinism and reversibility have a limited use and can be applied only in a few cases while irreversibility and randomness are the rules. The techniques used in this theory are based on agent-based modeling and are based on the post positivist epistemology. Accordingly, complexity theory approach is an intermediate between

postmodernism and modernism; moreover, it is closer to postmodernism (McKelvey 2004) because unlike systems theory, that focuses on homology and similarity, complexity theory focuses on the distinction and differences which is the point of differentiation between modernism and postmodernism (Schindehutte and Morris 2009).

It is worth mentioning that some researchers even discussed a more general term called “complexity science”, and has considered complexity theory as one of theoretical approaches categorized under this paradigm. In view of that, complexity science consists of a series of theoretical and conceptual tools (Walby 2007) and scientific approaches used to assess complex behaviors of physical and natural systems (Mathews et al. 1999). Each of these methods have different models or approaches for exploring the intended subject (Cohen 1999; McKelvey 2001). The complexity science undermines many of the existing underlying principles and beliefs which had long been used as basis for most often scientific research and traditional organizational theories (Mathews et al. 1999). It develops new beliefs regarding a particular type of system and equips itself with new methods that could improve research outcomes, as compared with traditional techniques (Schneider and Somers 2006). In fact, the complexity science in general and complexity theory in particular were developed because reductionist analyses could no longer analyze and explain the behavior of complex systems effectively (Anderson 1999) and the analysis methods used in many organizational and management studies are not suitable for the explanation of the complex phenomena (Mathews et al. 1999).

The complexity theory is primarily derived from approaches used in physics and mathematics. It attributes features to complex systems and that describe the complex behaviors not the system itself (Cadenasso et al. 2006). In fact, most of the research on complexity theory aimed to explain the behavior of system and interaction between the agents (Phelan 1999). Agent is a general term which is used for naming semi-autonomous phenomena that make up the complex system. They can be atoms, molecules, organisms, processes, people, groups, companies, industries, etc. (Benbya and McKelvey 2006).

But what does complexity exactly mean? What type of the system can be considered as a complex system? Simon (1962, p. 468) defines complex system as: “one made up of a large number of parts that have many interactions”. Moreover, Axelrod and Cohen (1999, p. 7) assert that “a system is complex only when there are strong interactions among its elements, so that current events heavily influence the probabilities of many kinds of later events”. American school of complexity science has defined the complex systems as “systems with many different parts which, by a rather mysterious process of self-organization, become more ordered and more informed than systems which operate in approximate thermodynamic equilibrium with their surroundings” (Peltoniemi and Vuori 2004, p. 9).

It can be said that complexity means a system with multiple elements and interdependent components (Simon 1962; Anderson 1999; Peltoniemi 2006) that are highly interactive and have complex relationships with each other (Peltoniemi and Vuori 2004) and their effectiveness and survival depends upon each other (Peltoniemi 2006). It could be argued that complexity is a relatively new approach

toward the systems composed of interdependent components and interacting agents (Benbya and McKelvey 2006) which has a focus on the interaction between the components (Frenken 2006). It tries to explain the process of directive interaction among the multiple elements and components within the system (Benbya and McKelvey 2006). However, in addition to the presence of multiple agents and interconnected and continuous interaction between them, some other features of a complex system have been identified by researchers which are outlined below.

In general, previous research has highlighted the most important characteristics of complexity theory, and particularly the characteristics describing complex systems as follows: 1. non-linear interactions between agents and components, 2. hierarchical nature of the system, 3. emergence, 4. co-evolutionary order creation and 5. self-organization.

*1. Non-linear Interactions* As implied by definitions of complexity and complex systems, interaction between system components is one of the key concepts of complexity and an underlying character of a complex system (Simon 1962; Anderson 1999; Phelan 1999; Fuller and Moran 2001; Peltoniemi and Vuori 2004; Peltoniemi 2006; Walby 2007; Lichtenstein et al. 2007; Schindehutte and Morris 2009; Anderson et al. 2012); this type of interaction leads to the formation of emerging and unpredictable patterns (ibid) and it steadily cause irregular patterns (Tan 2007). According to Phelan (1999), the interaction between actors and components in complex systems can explain the aggregate behavior of a system as a whole. In fact, such an aggregate behavior stems from activities and interactions of actors in the system. Based on Waldrop (1992), this is the distinguishing feature which makes a distinction between complexity approach and existing reductionist approaches, because reductionist approaches can explain the interaction of components but are incapable of explaining the system as a whole (Schindehutte and Morris 2009). For this reason, complexity science researchers believe that simple modeling (e.g., boxes and arrows causal models) no longer can be used for modeling complex systems with highly interactive and interconnected components (Anderson 1999). In general, complexity means that the agents of a system are dynamically linked to each other (Anderson et al. 2012). This dynamic interaction can affect many other attributes of a complex system that will be described below.

*2. Hierarchical Nature* Interactive behaviors of agents in a complex system over time may lead to the formation of networks which come in the form of meta-agents such as groups, hierarchies, structures, or complex processes of coordination (Benbya and McKelvey 2006). That is why Simon (1962) believes complexity is reflected in a hierarchical form. In other words, he considers the complex system as “being composed of subsystems that, in turn, have their own subsystems, and so on” (p. 468). As Simon pointed out, the relations between sub-systems of a complex system are much more complicated than formal organizational hierarchy. According to him, one of the representations of the complexity is the distinctive interactions between sub-systems on the one hand, and the interaction of components within a sub-system on the other hand. In such a system, the behavior of a sub-system in the short run is independent of the behavior of other components while in the long run it



will be dependent on them. Simon argues that in order to analyze the behavior of a complex system, it can be decomposed into its sub-systems and in fact the decomposable hierarchical structure of complex systems facilitates understanding and explaining complex systems and their components.

*3. Emergence* The concept of emergence is the focal point of complexity theory (Peltoniemi and Vuori 2004; Walby 2007). It is a concept that considers the relationship between various levels. In other words, higher levels are emerged from the activities of the lower levels of the system (Walby 2007). Accordingly, it is closely related to the hierarchical nature of the system that was mentioned earlier. This concept also rejects the reductionist approaches specific to natural and social sciences which try to reduce the systems and decompose them to the smallest components and units so that to analyze their behaviors. In other words, the concept of emergence provides a theoretical explanation for the association between system components without relying on a reductionist approach. According to Schindehutte and Morris (2009), emergence is not the result of the interaction between actors and components but, it occurs during the process of interaction. In fact, characteristics, qualities, patterns, or emergent structures are formed as a result of the interaction between individual elements (Holland 1998). The outcome of the emergence process is the creation of a new order together with self-organization.

*4. Co-evolutionary Order Creation* The emergence of order in a complex system is considered as a co-evolutionary process (Anderson 1999) that stems from nonlinear dynamics caused by interactions (McKelvey 2004) between heterogeneous agents and characterized by mutual dependence between them. In other words, an ordered pattern emerges from aggregate individual behaviors and interactions between them (Fuller et al. 2008) and without such interactions the formation of patterns cannot be expected (Anderson 1999). The interaction between the components of a system is a propulsion for the emergence of order (Lichtenstein et al. 2007). Therefore, a part of complexity theory is dealing with changing patterns of order and the formation of the new order (Fuller and Moran 2001; Anderson et al. 2012). This unpredictable non-linear behavior is also one of the key features of a complex system. It implies that a small change in one or two parts of a system could significantly affect the entire system (Anderson 1999; Walby 2007). According to Fuller et al. (2008), as compared with the mechanical linear approaches, nonlinear dynamic systems provide a better basis for theorizing the formation of order. Nonlinear interaction between actors is the main factor which results in the emergence of properties, unexpected dynamics, and self-organization of the system and eventually leads to complexity (Wu and David 2002). Thus, understanding it can help to explain the complexity of the system (Phelan 1999).

As mentioned earlier, the emergence of order is the result of a co-evolutionary process. Moreover, Simon (1962) also states that the structure of complex systems emerges within an evolutionary process over time. However, in a complex system we are also faced with the process of coevolution. According to Bateson (1979) coevolution can be defined with characteristics such as the emergence of interdependent species in a never-ending reciprocal cycle. Merry (1999, p. 272)



argues that “coevolution is the evolutionary mutual changes of species (or organizations) that interact with each other”. According to Murmann (2003), coevolution takes place if and only if both of the entities have a significant causal impact on each other’s ability to persist. Schneider and Somers (2006) contend that coevolution together with adaptation is one of the pillars of complexity theory. They argue that the two mentioned items act as the system agents that comply with external changes and evolve over time as a result of continuous interactions. In other words, this ability reflects the self-organization characteristics which are emerged as the result of interaction between agents, components, or sub-systems of a complex system. Accordingly, part of complexity science is focused on the study of and emerged structures or emergent adaptive behaviors and coevolution based self-organized behaviors in a complex system (Mathews et al. 1999; Benbya and McKelvey 2006).

*5. Self-Organization* Self-organization is associated with complex systems’ ability to create a new order and integration. Many of the complexity science researchers share the Goldstein’s definition of self-organization. Self-organization is a process by which new structures, patterns, and features emerge “without being externally imposed on the system” (Choi et al. 2001, p. 354). According to Kauffman (1993), the order emerged through such a process is called a spontaneous order. In this process, there is no internal or external guiding factor to set goals for the system or control actions; thus, events just happen spontaneously (Peltoniemi and Vuori 2004; Anderson 1999). Self-organization is the natural outcome of non-linear interactions between agents and their complex patterns of behavior (Anderson 1999). As described by Anderson (1999, p. 221), self-organization is a process where “pattern regularity emerges without the intervention of a central controller”. According to Peltoniemi and Vuori (2004, p. 10), “self-organization is an ongoing process since it will never complete its final outcome”. Unlike mechanistic theories that consume a central controller for a structure, complexity theory is based on this idea that order spontaneously emerges from interaction between organisms or agents (Benbya and McKelvey 2006).

In the following sections, we discuss the relevance of complexity theory for the entrepreneurial ecosystem research with an introductory review of the current state of entrepreneurship research using complexity approach.

## 4 Complexity in the Field of Entrepreneurship Research

Entrepreneurship is a field with old established links with the complexity science. The link between these two dates back to 1989 when Bygrave (1989) published his work on theorizing entrepreneurship through the application of chaos theory. Since then, the complexity science was utilized in entrepreneurship research in various forms. For instance, it was used for assessing the emergence of new ventures and explaining the dynamics of business (Lichtenstein 2011), examining the dynamics of

entrepreneurial actions of nascent entrepreneurs (Lichtenstein et al. 2007), explaining knowledge processes in industrial clusters (Lindsay 2005), as a new paradigm for different domains such as strategic entrepreneurship (Schindehutte and Morris 2009), and social entrepreneurship (Goldstein et al. 2008; Swanson and Zhang 2011). In addition, some researchers such as Fuller et al. (2008), Lichtenstein et al. (2007), and Lichtenstein (2011) investigated the application of complexity science and complexity theory to study entrepreneurship, expand the scope of research, and gain new insights about the entrepreneurship phenomenon.

There are several reasons for the significance and efficient application of complexity theory in entrepreneurship research. First of all, it can provide researchers with useful models for explaining the emergence of entrepreneurship (Lichtenstein 2011) and new venture creation, because complexity theory could equip them with numerous insights toward the creation of new businesses, organizational structures (Fuller et al. 2008) and behaviors. Second, this theory makes it possible to conduct research on multiple levels (Lichtenstein 2011) and it is a feature that is very important in gaining insight into the entrepreneurial process. In fact, complexity theory is a new way of thinking about systems composed of multiple agents, for instance businesses (Benbya and McKelvey 2006). Third, the key techniques of complexity theory i.e. the agent-based models (Phelan 1999; Peltoniemi 2006) are the only way to create empirically valid generalized statements about entrepreneurial dynamism (McKelvey 2004). According to him, such models make it possible to analyze complex causal dynamics with the goal of proposing a theory with higher levels of generalization and with greater legitimacy and practical credibility. Finally, the nature of present reductionist methodologies such as equilibrium models makes significant challenges to the dynamic nature of entrepreneurship (Fuller et al. 2008; Schindehutte and Morris 2009). That is why a significant portion of complexity research in the field of entrepreneurship aim to make an understanding of some of the nonlinear non-mechanical dynamics of entrepreneurial action (Lichtenstein 2011).

At the heart of both complexity and entrepreneurship remains the concept of “emergence” which has facilitated and inspired entrepreneurship research to focus on this concept. In view of According to Goldstein (1999, p. 49), the concept of emergence: “refers to the arising of novel and coherent structures, patterns, and properties in . . . complex systems”. Entrepreneurship researchers have a focus on the emergence of new challenges (Bygrave 1989). As discussed in the previous section in detail, complexity researchers have a focus on the dynamics of emergence (Mathews et al. 1999; Peltoniemi and Vuori 2004; Walby 2007). In both of the fields, researchers study interactions and emergence of new phenomena at multiple levels of analysis (Lichtenstein 2011). Emergence in this state remains the key concept for theorizing in the realm of entrepreneurship. In this regard, emergence can be defined as the creation of novelty, new businesses, new products, new processes, or new organizational structures (Fuller et al. 2008).

A research that has an emphasis on the emergence tries to focus on what emerges and how and when it emerges (Fuller et al. 2008). Emergence as a characteristic of complexity theory leads to the creation of a new order; in other words, it leads to the formation of structures, processes, and characteristics realize within the system and