

## **Business ecosystem as a perspective for studying the relations between firms and their business networks**

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### **Abstract**

In this paper we try to mature the business ecosystems concept as a research perspective for studying the relation between firms and their business networks. As economic activities are changing from dominantly stand-alone to networked, new perspectives are needed to study these relationships. The business ecosystem metaphor provides an interesting starting point for such a perspective. We provide an overview of current research on business ecosystems and we define the aspects that are core to a business ecosystem perspective, namely, the firms, the network, performance and governance. We examine how these core aspects can be further developed building on (social) network theory, biological ecosystem theory and complex adaptive system theory. Finally, we proposed to integrate these core aspects into a comprehensive complexity logic.

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## **1. Introduction**

The purpose of this paper is to take a step in maturing the business ecosystems concept as a research perspective for studying the relation between individual companies and the business networks around them. In section two of this paper we will argue the need for a new perspective.

Until now, research in business ecosystems has taken different approaches, the main ones being the metaphorical approach, which uses natural ecosystems as a metaphor for understanding business networks, and the reality-based approach which regards business ecosystems as a new organizational form. We will discuss these approaches in the section three of this paper and we will argue that, while both approaches have their merits, they still fall short in explaining the reality of the relation between individual companies and the business network, in terms of strategic behavior, dynamics and performance.

In section four of this paper we will therefore examine how the metaphor can be strengthened and develop it towards a research perspective. We will do this by first defining the aspects that are core to the study of the relation between individual companies and their business networks. We will draw upon different existing research streams, namely (social network) theory, biological ecosystem theory and complex adaptive system theory, to see how those core aspects could be further developed.

In the fifth section of this paper, we will attempt to integrate these core aspects into a comprehensive business ecosystem logic. The sixth section of the paper contains conclusions, limitations and suggestions for further research.

## **2. The need for a new perspective**

As economic activity is changing from stand-alone to interconnected economic agents forming a network economy as it is today, research on business strategy evolves or includes more dimensions to better understand the continuous interaction and behavior of interconnected organizations (Nohria and Eccles (1992) in Ghisi and Martinelli (2006). The paradigm of atomistic actors competing against each other in an impersonal marketplace is becoming less adequate in a world in which firms are embedded in networks of social, professional, and exchange relationships with other economic actors (Granovetter, 1985; Gulati, 1998; Galaskiewicz and Zaheer, 1999; Gulati, et.al, 2000). The environment should no longer be seen as faceless, atomistic, and beyond the influence of the organization, as assumed by the current strategy management doctrine (Hakansson

and Shenota, 2006).

As proposed by Hoskisson et.al (1999), rapid change in technology, the rise of information age and an increased level of globalization significantly change the competitive landscape, i.e., the nature and pace of competition between firms. This consequently influences the nature of research in strategic management. Research in strategic management will likely experience increased integration of multiple theoretical paradigms which provide a balance between internal and external explanations of the complex relationships in the new competitive landscape. Ritter and Gemünden (2003) point out that, in the network economy, the firm's competitiveness does not only depend on its internal competence but also on its ability to interact with its environment. Failure in establishing and maintaining this external competence will limit the firm's strategic flexibility to its in-house resources.

Given the increasing pace of today's markets and the complexity of today's technologies that ask for interconnected webs of actors (Barabasi, 2002), firms should be able to effectively use their relationships with customers, partners or competitors. This can only be obtained by understanding such interconnected business models, and by understanding the factors and mechanisms that govern such networks. As strategy research shifts from individualistic and atomistic explanations towards more relational, contextual and systemic understandings, the study of strategic management from a network perspective has become a major issue. Borgatti and Foster (2003) found that the literature in social networks (including business networks) shows an exponential increase.

Still, despite the abundant literature on networks and inter-organizational relationships, this research remains fragmented. At least it can be observed that different pieces of theory do not seem to fit together due to the very different backgrounds from which inter-organizational relationships are addressed, that different trends are followed and different methods are used, and that different aims and objectives are addressed in different studies (Ritter and Gemünden, 2003). This situation causes several challenges for studies of inter-organizational relationships to move further in conceptual development and empirical investigation (Ritter and Gemünden, 2003). Another challenge for scholars studying networks and alliances is to bridge the chasm between theory and practice and translate some of their important insights into useful policy recommendations for the practitioners (Gulati, 1998).

### **3. Current research on business ecosystems**

Considering the challenges described above, it is interesting that Moore (1993; 1996a) used the analogy of business ecosystems to study interconnected organizations, to understand the dynamics

resulting from it and to find explanations of the observed phenomena. The use of analogy and metaphor have since long been a source of enlightenment for scientists to understand the phenomena they study (Hannon, 1997). Business researchers have begun to adopt a biological ecosystem models in the analysis of business relationships and strategic decision making (Iansiti and Levien, 2004a; 2004b). Managers and academics are coming round to recognizing the value of the ecological metaphor for understanding the complex network of business relationships within and across industries (Harte et.al, 2001 in Adomavicius et.al, 2006).

The terminology of *business ecosystems* was initially used by Moore (1993; 1996a) and then was developed by several other researchers with different focus and approaches. Definitions of business ecosystems mainly stress the interconnectedness of economic agents, and the fact that they depend on each other for their success and survival (Peltoniemi, 2005; Den Hartigh and Van Asseldonk, 2004). When Moore (1993; 1996a) and Iansiti and Levien (2004a; 2004b) introduced the concept of business ecosystems, it provided a way to enrich the study of business network by considering the firm as an interconnected part of its larger environment, by emphasizing the role of individual firm and by stressing the importance of collective health of the system in which the firm is embedded. Iansiti and Levien (2002; 2004a; 2004b) developed the concept further by operationalizing the concepts of ecosystem health measures (2002) and by describing the generic strategies that can be taken by firms depending on the different roles they have in the ecosystem (2004a; 2004b).

Although Moore claims that the business ecosystem concept could overcome the weaknesses of previous frameworks such as strategic alliances and virtual organizations (1996a), some important issues need to be addressed. For some time, business ecosystems has been among the hot concepts in strategy research (Beckam, 1997), but while it is evident that the ecological analogy is important in business literature, there has been a lack of analytical tools so far that provide value to the practitioners (Adamovicius et.al, 2006).

### **3.1 Overview of the literature**

Business ecosystem is still a relatively new field of study, with different use of the terms, perspectives, and goals by the different researchers. In table 1 we provide an overview of studies on business ecosystem that shows the definitions as used in these studies. The table also contains a description of the research conducted (unit and type of analysis) and a remark concerning the use and depth of the business ecosystem metaphor. It should be noted that there are several other ways in which *ecosystem* in business related terms, such as digital business ecosystem, social ecosystem, economy as an ecosystem, industrial ecosystem, ecosystem model of technology evolution, and value ecology. These are out of the scope of this study, however.

Table 1. Overview of business ecosystem research

Article	Publication	Definition used	Unit of Analysis	Type of Analysis	Remark
Moore (1993)	Paper	The term circumscribes the microeconomics of intense co-evolution coalescing around innovative ideas. Business ecosystems span a variety of industries. The companies within them co-evolve capabilities around the innovation and cooperatively and competitively support new products, satisfy customer needs, and incorporate the next round of innovation (p.15).	Business network	Conceptual	Try to understand the underlying strategic logic of change by using the language of a biological ecosystem or logic in it.
Moore (1996a)	Book	As in Moore (1993).	Business ecosystem	Conceptual	Try to use analogy from a biological ecosystem to describe how a firm fails or leads a business ecosystem. There is still little explanation of the underlying mechanism in this complex relationship.
Moore (1996b)	Paper	No definition provided.		Conceptual	Discuss framework for strategy making. Innovation requires coevolving with other contributors through partnerships, alliance and standards. Bargaining power is key to becoming a winner and a leader. Source of potential sources of bargaining power, continued innovation, criticality, and embeddedness.
Iansiti and Levien (2004a)	Paper	Basically, a business ecosystem is a business network. Business ecosystem are formed by large, loosely connected networks of entities, that interact with each other in complex ways, and the health and performance of a firm is dependent on the health and performance of the whole.	Firm in relation to its business network	Conceptual	Offer a framework for assessing the health of company's ecosystems, determining the place in it and developing a strategy to match the role
Iansiti and Levien (2004b)	Book	As in Iansiti and Levien (2004a).	Business networks; relations; structure	Conceptual & empirical	Although there were efforts to go beyond a descriptive metaphor, by providing health measurements, generally this study is still in the stage of descriptive metaphor. The underlying mechanism is not extensively established.
Peltoniemi (2004)	Conference paper	Business ecosystem concepts can be beneficial in analyzing systems and their features and will contribute in providing a holistic or system view of modern interconnected business	Business ecosystem	Conceptual	The objective is to define business ecosystem by comparing cluster, value network and business ecosystem.

Article	Publication	Definition used	Unit of Analysis	Type of Analysis	Remark
Peltoniemi and Vuori (2005)	Conference paper	A business ecosystem is a dynamic structure which consists of an interconnected populations of organizations, be they small firms, large corporations, universities, research centers, public sector organizations and other parties which influence the system. It is defined that business ecosystem contain a population of organizations.	Business ecosystem	Conceptual	Try to define business ecosystem by also elaborating the complexity logic in it.
Peltoniemi (2005a)	Report	Business ecosystems consist of a large number of participants that can be business firms and other organizations. They are interconnected in a sense that they have an affect on each other. This interconnectedness enables various interactions between the members. These interactions can be both competitive and cooperative. This interconnectedness leads to a shared fate. The members are dependent on each other, and the failures of other actors can result in failures of a certain firm. The members of business ecosystem are capable of conscious decisions on their own part. The firms are aiming at innovations and commercial success and hope to take advantage of other members and their capabilities. This is challenging since a business ecosystem is coupled to its environment that may change rapidly and unpredictably. Thus, business ecosystem is fundamentally a dynamic structure that evolves and develops in process of time.	Relationship of organization population both at organization and population level	Conceptual	Provide a theoretical framework for the study of behavior and development of an organization population.
Peltoniemi (2005b)	Discussion paper	Business ecosystem consists of a large number and interconnected participants that can be business firms and other organizations which interact to each other both competitively and cooperatively. .	Business ecosystem	Conceptual at ecosystem level	
Peltoniemi, Vuori and Laihonon (2005)	Conference paper	A dynamic structure which consists of an interconnected population of organizations. A business ecosystem develops through self-organization, emergence and co-evolution, which help it to acquire adaptability.	business ecosystem internal and external diversity	Conceptual	Discuss the point of view of an organization that operates in business ecosystem. The conscious decision about its internal structure and aims to adjust its internal diversity to its environment.
Vuori (2005)	Conference paper	A dynamic structure which consists of an interconnected population of organizations.	Knowledge intensive organization as part of business ecosystem and is relation	Conceptual at ecosystem level	Discuss knowledge intensive organization as part of business ecosystem and try to develop conceptual model for construction of agent-based model.
Den Hartigh and Van Asseldonk (2004)	Discussion paper	Network of suppliers and customers around a core technology, who depend on each other for their success and survival.	Firm in relation to its business network	Conceptual	Provide research framework for investigating the relation between network structure, firm strategy, and the pattern of innovation diffusion.
Den Hartigh et.al (2006)	Conference paper	Network of suppliers and customers around a core technology, who depend on each other for their success and survival.	Firm in relation to its business network	Empirical	Provide analysis of Dutch IT ecosystem using network modeling technique.

Article	Publication	Definition used	Unit of Analysis	Type of Analysis	Remark
Quaadgras (2005)	Conference paper	A set of complex products and services made by multiple firms in which no firm is dominant.	Alliance or firm relation	Empirical at conceptual level	Ecosystem is only used as terminology of network. No concepts on business ecosystem as developed by previous researchers is used. She uses network modeling technique to define RFID business ecosystem and predict firm participation.
Foer (2006)	Book review	No definition provided.	-	-	Discuss business ecosystem ideas proposed by Iansiti and Levien from antitrust point of view. Business ecosystem will no doubt provide solace to those who would replace antitrust with what will be presented as more efficient regime.
Gossain and Kandiah (1998)	Paper	No definition provided.	-	Conceptual	Business ecosystem is more than another way of doing business. It is a paradigm shift in order to understand the organization's core competencies and reinventing the way an organization do business.

From the table we can conclude that business ecosystem study is still in the early phase of development as a promising strategy making tool. The definitions of what being studied are still widely varying, i.e., there is no consensus even on what a business ecosystem is. Most of the studies are also at conceptual level and are rarely followed by empirical studies. Most of the research still deals with developing the concept of business ecosystems by using the metaphor of a biological ecosystem.

Moore (1993; 1996a) developed the business ecosystem concept and together with Iansiti and Levien (2004a; 2004b) his book has become the most cited work in the study of business ecosystems. They all argue that a new concept is needed to shape strategy in the interconnected business by using metaphor from biological ecosystem to communicate the insights on the working of business ecosystem and create strategy out of it. Following this concept, several other uses of ecosystem terminology have emerged, such as digital ecosystem (De Tommassi, 2005; Seigneur, 2005; Zhao, 2003), entrepreneurial ecosystem (Cohen, 2006), social ecosystem (Mitleton-Kelley, 2003) and technology ecosystem (Adomavicius et.al, 2006).

Iansiti and Levien (2004a; 2004b) extend the concepts of Moore by defining the role of actors in the business ecosystem and relating these roles to the collective properties of their ecosystem. Using the analogy of a biological ecosystem, these roles are defined as *keystone*, *dominator* and *niche player*. Iansiti and Levien show that business networks are rarely homogenous and there are

members perform distinct and unequal roles.

Iansiti and Levien (2004a; 2004b) define the network as loosely coupled system, which requires only interoperability and extensibility based on satisfying just sufficient protocols for interaction and leveraging. They identify that the highly distributed and networked structure in industries today is a relatively recent phenomenon requiring a new framework of thinking about industry health and what constitutes an industry in the first place. There are a large number of distinct organizations involved in delivering a product to the consumer which makes them share a common fate which could be tied to the fate of the product. This kind of network resembles a biological ecosystem.

The effort to understand the underlying mechanism in business ecosystem is done by Peltoniemi (2004; 2005a; 2005b), Peltoniemi and Vuori (2005), Peltoniemi, Vuori and Laihonon (2005) and Vuori (2005). Yet, the results are still in the conceptual stage, as a base for a theoretical framework and as a concept for developing a simulation model. Several empirical studies, which are based on the developed concept, have also been conducted by Den Hartigh and Van Asseldonk (2004) and Quaadgras (2005). These studies take the business ecosystem as an object of study and use network techniques to analyze business ecosystem such as the influence of network structure to the performance of the firm and network. Later on during 2005-2006, a different focus of study is also presented by Moore (2006), Foer (2006) and Gundlach (2006) by using this concept to discuss issues in antitrust cases. Den Hartigh et.al (2006) use network theory to develop measures of ecosystem health and empirically analyze and measures it in Dutch IT ecosystem.

Quaadgras (2005) uses network theory to empirically explain the behavior of large, diverse firms with respect to joining the network based on the model of absorptive capacity and exploration/exploitation. To some extent, this model can also be further developed to analyze firm performance in the network.

An effort has been done by Jimenez (2007) who uses network theory to assess network health in a less complex way. He approaches two of the three measures as defined by Iansiti and Levien (2002; 2004b), i.e., productivity and robustness, by using a structural approach in which attributes of relationships between actors are the focus of analysis. Yet, his study has not touched on the third measure as mentioned by Iansiti and Levien (2002; 2004b), i.e., niche creation.

Studies in business ecosystem have not said much on the governance. Moore (1996) mentions that the most used ways of governing business ecosystem relationships are community governance



systems and quasi-democratic mechanisms. Moore's idea on governance is by comparing ecosystem governance to markets and hierarchies. He mentions that the ecosystem internalizes the systems of firms and the markets that connect them under the guiding hands of community leaders (2006). Iansiti and Levien (2004b) mention that business ecosystems are governed by shared fate, but they do not intensely discuss this guiding mechanism. Vos (2006) describes business ecosystem governance as providing network members with an incentive and vision to strive for a common goal, giving them the freedom to reach that goal on own initiatives so that their motivation is not hampered by obstruction, while using steering mechanisms to ensure that their activities will reach this common goal, in an effort of improving the business ecosystem's capability of coping with exogenous changes and the internal pace of innovation.

Despite the fact that many studies have been conducted into business ecosystems, there are still many important issues that need to be addressed. Among these are the definition of business ecosystems and the use of metaphor as a research instrument.

### **3.2 Definition of business ecosystem**

One of the issues to be discussed in this concept is related to the definition of a business ecosystem. In network studies, there have been discussions about the ontological status of network organizations (Borgatti and Foster, 2003). A similar discussion can apply for business ecosystems: "Is the business ecosystem a metaphor of a business network or a description of an organizational form which is bigger than a business network?"

Moore (1993; 1996a) regards a business ecosystem as a perspective to understand how an economic community works. He calls an economic community a business ecosystem and suggests that this term replaces the term industry. Moore starts by defining a business ecosystem as an object (see figure 1) and based on this object, develops the appropriate strategy framework to analyze strategy making.

As a form bigger than a business network, we could ask whether a business ecosystem is a new kind of organizational form with unique characteristics and relationships which exists in reality or it is just a reification of a business network. As shown in figure 1, a business ecosystem as proposed by Moore includes more than the network (or extended enterprise in Moore's terminology). It also includes the owners and other stakeholders as well as powerful *species* such as governmental bodies, associations and standardization bodies. Since organizations are already thought to be embedded in a network of economic and social relations (Borgatti and Foster, 2003), we can ask whether such a new organizational form is needed to build the concept and find explanations on this

loosely coupled system of interconnected networks.

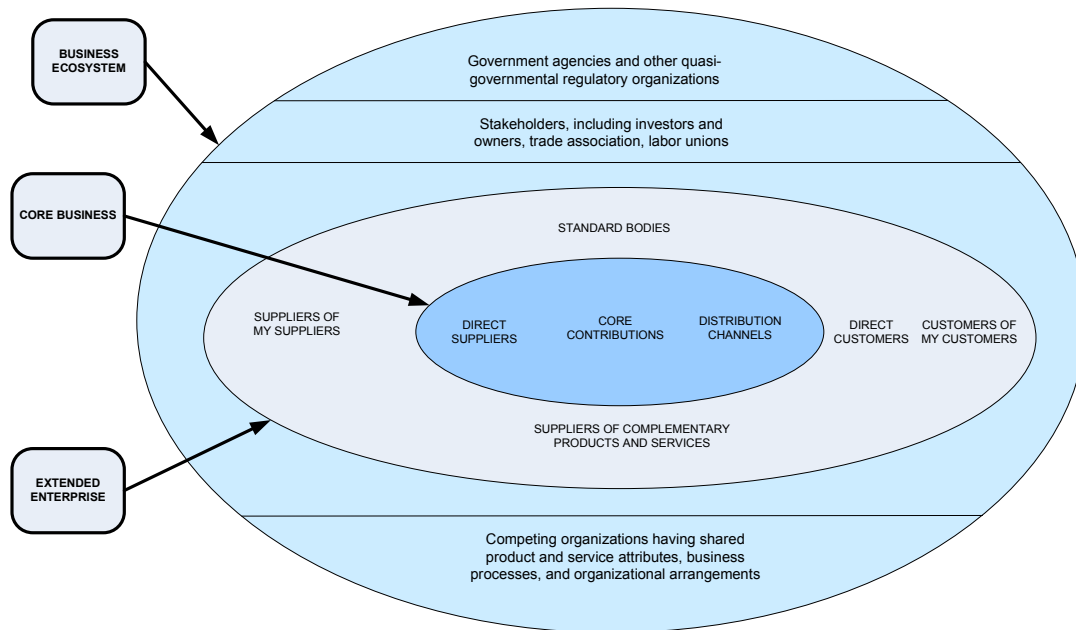


Figure 1. Business ecosystem ( Moore, 1996a)

As a metaphor, the business ecosystem concept can enhance understanding and provide creative thinking when studying business networks. Regarding a business network as an ecosystem opens up a new way of looking at the structure, interaction and exchanges among organizations. It moves the analysis to the system level in which many sectors and industries behave like a massively interconnected structure of organizations, technologies, consumers and products (Gundlach, 2006). Within this context, the focus of the analysis will consequently be on the relations, interactions and dynamics at the system level. As part of larger system, firms can play different roles to increase their performance, but since the system involves interconnected firms, those roles could propagate throughout the system influencing the system fitness and through this again the firm fitness.

Iansiti and Levien (2004a; 2004b) do not pay much attention to defining the business ecosystem but rather develop a perspective to understand business networks. This provides a source of vivid and useful terminology and powerful insights for studying strategy in business networks. They seek to develop a concept that borrows the terminology and insights from biological ecosystems. They believe that in many ways biological ecosystems are simply a point of departure for analogies and metaphors as well as for theoretical foundations to understand the challenges and opportunities for formulating strategies in a networked world (p.37). Starting from the needs to understand and

manage business networks, Iansiti and Levien used the biological ecosystem as an analogy (p.8-9). They believe that a particular powerful way to conceptualize business networks is to compare them to biological ecosystems (p.35) because specific features of these ecosystems, like the structure, the relationships among members, the kinds of connection among them, and the differing roles played by their members, suggest important analogies for understanding these business networks (p.9). Iansiti and Levien also explicitly mention that they do not argue that industries are ecosystems or even that it makes sense to organize them as if they were (p.9). They also state clearly that they do not claim that business networks are ecosystems (p.37).

Thus, Iansiti and Levien (2004a; 2004b) use the business ecosystem as metaphor for business networks while Moore defines a business ecosystem as more than just business network. As shown in figure 1, the boundary of business ecosystem is actually hardly different from that of a (strategic or business) network. Several studies of business networks have already included, besides the organizations that are directly connected to the core business of firms, indirectly related organizations or individuals, dynamic relations, cooperative and competitive relations and relations with common objectives.

The difference between a network and a business ecosystem is therefore not in the object of study, but in the perspective that is used to analyze interconnected businesses. In other words, in the way we look at the relationships or interactions among the members and their environment, at the roles and interests of the members of the system, and at the mechanisms guiding these interactions toward the achievement of shared goal.

We therefore think that it will be most interesting and useful to use the business ecosystem concept as a perspective to understand business networks, rather than as a new organizational form. Such a perspective will provide a logic, different from the current logic of understanding inter-organizational relationships from the network perspective. The business ecosystem perspective offers a new way to obtain a holistic view of the business network and the relationships and mechanisms that are shaping it, while including the roles and strategies of the individual actors that are a part of these networks.

### **3.3 The use of business ecosystem as a metaphor**

Analogies and metaphors have been used in art and science for a long time, and nature has often been a rich source of such inspirational analogies (Hannon, 1997). A useful role for analogy in academic research is to provide an intuitive understanding of how a problem can be approached

(Foster, 1997). The natural ecosystem as a metaphor drives business studies to go beyond the atomistic and internal view of the firm, since a natural ecosystem is a complex, self organizing system. We could ask ourselves in how far this metaphor and analogy can be used to study business reality? This question emerges since natural ecosystems as an analogy and metaphor are systems without the capability for intentional and planned behavior and action (Korhonen et.al, 2004; Iansiti and Levien, 2004b). Iansiti and Levien (2004b) also realize the danger of using the analogy and metaphor from biological ecosystems for understanding business networks, and they point out three critical characteristics that business networks have while biological ecosystems do not, namely innovation, competition for members, and intelligent actors. Iansiti and Levien (2004b) answer this limitation by extending the metaphorical foundation from ecosystems as narrowly defined in ecology to a much wider universe of evolved biological ecosystems, arguing that for business networks, too, the choices available to decision makers are limited and shaped by the forces governing the entire (economic) system. While it is well-understood that decision makers may have limited choices due to environmental forces, it could also be argued that intelligent (human) actors will always be able to proactively anticipate changes, or even initiate them.

There is little doubt that the natural ecosystem metaphor has increased the understanding of business networks and has promoted creative thinking in this field. Yet, despite of this, the question of the appropriateness of using the metaphor should be resolved. Korhonen (2005) mentions that a metaphor cannot be wrong or inaccurate, that it can only be useful or not useful, and that its usefulness is to be determined in terms of its contribution to the real world. This suggests that we should go beyond the metaphor and reveal and empirically test the underlying mechanisms and relations to determine the degree to which metaphor is appropriate.

To proceed from the current situation, we see two directions that could be followed to increase the depth and practicability of the concept. We use the categorization as developed by Eoyang (2004) to map the current position of the study of business ecosystem and the direction to go (see table 2).

Table 2 Categorization of phenomenon of interests and available tools for understanding and intervention (adopted from Eoyang, 2004)

Phenomena	Tools for understanding and intervention			
	Practice	Weak Metaphors	Strong Metaphors	Mathematics
<b>Surface structure</b>	Act in response to the surface structure	Describe patterns that emerge in the business network with metaphors drown from complexity logic	Intervene using tools derived from complexity to influence the surface structure of business network	Represent complex relationship among variables of the surface dynamics of complex business network

<b>Evident deep structure</b>	Act in response to the deep structures of business network that are evident when it is known where and how to look	Describe subtle structures that shape business network using complexity metaphor	Influence the self-organizing process in business network by shifting dynamics that are visible	Represents the more subtle non linear dynamics of business network using tools of mathematics
<b>Subtle deep structure</b>	Act in response to structures that are so deep within the nonlinear dynamics that the analyst unaware if what the patterns are	Support system as it describe for itself the nonlinear dynamics that drive its tension, productivity, and history	Represents the system dynamics so that the subtle deep patterns are visible and accessible to influence	Use mathematical tools to discover subtle structures in complex human system

In the dimension *phenomenon of interest*, there are different layers of depth to which we could take the study of business networks, namely surface structure, evident deep structure, and subtle deep structure (Eoyang, 2004). Based on the overview of the literature, given the fact that most contributions to date are conceptual rather than empirical, we position the current study of business ecosystems mainly in the first layer. In the dimension *tools for understanding and intervention*, there are different levels of abstraction, namely practice, weak metaphors, strong metaphors and mathematics (Eoyang, 2004). Based on our above discussion of the use of metaphor, we position the current study of business ecosystems mainly in the weak metaphor column. Given this positioning of the current state of research, we think that the further development of the business ecosystem perspective should be done through:

1. Enriching current concepts by increasing the level of abstraction of the required tools to understand and intervene in the system. A first step in this direction would be to develop the business ecosystems concept towards a strong metaphor by identifying variables and underlying mechanisms in business network using appropriate theories (such as complex adaptive system, biological ecosystem, network theory), conceptualizing those variables and mechanisms in business networks, and finding how the mechanisms influence the working of the system. A next step would be to represent those complex relationships among variables and underlying mechanisms into mathematical relationships to uncover the structures and dynamics of the system.
2. Moving towards a deeper layer of understanding with respect to the phenomena of interest by empirically testing them. In this empirical testing, the tools developed under (1) should be used.

In the remainder of this paper, we will make a first effort to mature the business ecosystems concept into a strong metaphor.

#### 4. Business ecosystem as a perspective

In his book, Moore (1996a) explains the basic idea of the business ecosystem perspective in strategy making. It is a simple guide for firms to understand the economic system evolving around them and to find ways to contribute to it. It stresses that in an economy of constant change, what a firm does is not as important as how a firm's capabilities relate to what others are doing. Strategy making involves having an awareness of the big picture and finding ways to play a role in it. This simple statement is no longer simple when it is confronted with the reality of the networked economy, since awareness of the big picture will require an understanding of how the system behaves, i.e., of the dynamics and of the mechanisms from which they result.

The differences in scope between a firm, a network and a business ecosystem in strategic management as suggested by Moore (1996a) are shown in table 3. It is suggested by Moore (1996a) that the business ecosystem perspective extends the traditional strategic management (core products and services) and network (extended enterprise) approaches in the sense that a company should be considered not as member of a single industry but as part of a business ecosystem that crosses a variety of industries.

Table 3. Increasing Scope of Strategic Management (Moore, 1996a)

	Scope Of Strategic Management		
	Core Products And Services	+ Extended Enterprise	+ Coevolving Ecosystem
<b>Concept of business relationships</b>	A portfolio of transactional and long-term preferred customer and supplier relationships	Managed system of relationship	Coevolving, symbiotic, self-reinforcing system of strategic contributions
<b>Focus of continual improvement</b>	Products and processes	Organizational interactions, extended processes	Investments in innovation by members of community
<b>Measure of improvement</b>	Reduction in product defects; reduction in product deviations from standard	Rate of progress on improving products and processes	Rate of progress on creating end to end total experiences of dramatic value to customers
<b>Most important contracts governing the relationship</b>	Product specifications, process specifications, and TQM standards	Letters of agreement among key organizations	Community governance systems, quasi-democratic mechanisms
<b>Alignment of the intentions of key parties</b>	Alignment on the importance of consistency of customer/supplier satisfaction and performance on benchmarks	Alignment of the parties' strategic direction and investments	Alignment of the community around a shared vision of a desired future and the road map and key contributions required.

Several characteristics found in Moore (1996a) and Iansiti and Levien (2004b) suggest that the business ecosystem perspective enables us to see different things than we would see from a more

traditional strategic management or network perspective:

1. It emphasizes the view that the network can be a source of firm renewal rather than being the external threat that is often the focus of existing frameworks (Iansiti and Levien, 2004b, p.37).
2. It not only examines the relationships between firms/organizations in the business network, but it also defines the roles that can be played by firms and the strategies they can follow in maintaining the health and performance of themselves and their business networks. A traditional network perspective mostly focuses on the interaction of the network members but less on the roles they play and the strategies they follow.
3. It recognizes that both cooperative and competitive relationships and their interplays are important for the survival of firms and their networks (Moore, 1993; Iansiti and Levien, 2004b).

#### 4.1 Aspects to be developed

To mature the business ecosystem perspective into a strong metaphor, we have to identify variables and underlying mechanisms that will reveal and explain the phenomena of interests and we will have to provide appropriate tools for understanding and intervention. We will use several theories to explain, fill in the gaps and enrich the different aspects of the business ecosystem perspective. Based on its basic characteristics and current study of business ecosystem, four aspects need to be further developed, namely (1) the firm, (2) the network, (3) performance and (4) governance. An assessment of the different concepts toward these aspects of the business ecosystem perspective is shown in table 4.

Table 4. Concepts for the aspects of the business ecosystem perspective

Aspects	(Social) Network theories	Biological Ecosystem	Complex Adaptive System	Business ecosystem
<b>Firm</b>				
- Characteristics			Active and Strategic and posses connectivity with others	Strategic pursuing economics interests
- Roles	Actors occupying certain position in network	Keystones, Dominator, Predator & Prey		Keystone, dominator, landlord, and niche player
<b>Network</b>				

Aspects	(Social) Network theories	Biological Ecosystem	Complex Adaptive System	Business ecosystem
- <b>Structure</b>	Network density, structural holes, structural equivalence, and core versus peripheral firm		Self-organizing loosely coupled of interconnected agents	Loosely coupled system of interconnected agents
- <b>Dynamics</b>	Endogenous and exogenous dynamics resulting in network effects and social interaction effects		Co-evolution and non-linear processes (adaptation, emergence, self-organization)	
<b>Performance</b>	Cohesion, connectivity, density, trust, closeness, number of ties, reciprocity	Vigor, organization, Resilience Stability, diversity and productivity	Coherence, Stability, and	Productivity, Robustness, Niche creation
<b>Governance</b>	Price, authority, social governance (purpose and trust)		Co-evolution, emergence, self-organization, and adaptation	Community governance (quasi-democratic), Shared fate

## 4.2 The firm

The business ecosystem perspective emphasizes the role being played by actors in the business network. Drawing from current works on business ecosystem, there are four different strategies that can be pursued by firms, reflecting the roles being played in the network. There are still gaps in this categorization though. The first one is related to the characteristics of the actors: how one can identify the roles being played by firm in the network (Blackburn, 2005). The second one is related to the behavior of these actors. It can be further developed using different concepts from biological ecosystems, network theory, and complex adaptive systems theory.

### *Characteristics*

In complex systems theory, an agent (or a firm in this respect) is an active and strategic one but with fragmented information. These agents find themselves in an environment produced by their interactions with other agents in the system (Waldrop, 1994). Agents possess varying degrees of connectivity with other agents through which information and resources can flow (Choi et.al, 2001) and they possess schema, which are norms, values, beliefs and assumptions that are shared among the collective (Schein, 1997 in Choi et.al, 2001). A few dominant schema dictate the majority of behaviors, which are typically non linear and can lead to complex behavior even if only a few schemas or rules are being enacted (Choi et.al, 2001).

Agents, as part of the system, learn how to perform tasks by developing their own survival



strategies. Their behavior is driven by a set of rules, such as:

- A set of operating rules driving the performance of tasks necessary for survival.
- A set of rules for evaluating that operating performance.
- A set of rules for changing both the operating and evaluating rules, i.e., for learning. These rules might well involve cross-fertilization between an agent's existing set of rules and the rules of other agents, a kind of mating between the rules of different agents (Stacey, 1996).

### *Roles*

Building from biological ecosystems, a further characterization can be made of the roles that can be played by firms in the network. There are several articles that focus on roles, especially on the keystone role. See, for example, Power and Mills (1995), Brose, et.al (2005) and Power et.al (1996). Those articles elaborate on the role of a keystone to maintain the health of its ecosystem as well as on a concept to identify a keystone.

Several studies in networks found that the position of firms in the network influences firm behavior and performance, see, e.g., Powell et.al (1996), Walker et.al (1997 in Gulati, et.al 2000). Insights from network theory can also be used to enrich the role and behavior of agents occupying certain positions or having certain network resources, i.e., network relationships as proposed by Gulati, et.al (2000). Centrally positioned firms or hubs within network may hold considerable power access to the ecosystem or networks because of the dependence of niche players in the networks on the hub firm (Gundlach, 2006).

## **4.3 The network**

As for the network, there are lots of studies in network theory that can enrich the business ecosystem concept. As agents are interconnected, small changes can propagate through the system to make it highly dynamic and unstable. Further examination can be done on the structure and dynamics of business ecosystems.

### *Structure*

It is very important to characterize the structure of complex networks since the structure always affects the function and the behavior of a dynamical system, especially a complex one, which can only be understood by looking at the intrinsic interactions among the multiple individual parts. Although much has been written on the structure of networks, few studies are available on the structure of business networks from the business ecosystem perspective. Thus, the examination of

structure of business network will have to be built on current studies on structure from network theory and from complex adaptive system theory.

Within network theory, studies on network structure refer to the pattern of relationships within which the industry is embedded (Gulati et.al, 2000). Various factors have been identified, such as network density, structural holes, structural equivalence, and core versus peripheral firms which can influence the profitability of industries and of the firms within them. Building on these insights, the structure of business network, which is not only limited to industry but goes beyond industries, could be defined. For example, the existence of structural holes could provide an explanation to the characterization of the firm occupying this position and its role on influencing its own survival and the health of the network.

Within complex adaptive systems theory, business network is considered as a self-organizing, loosely coupled system of interconnected agents. A low ratio of connection between agents produces order, a high ratio of connections between agents produces chaos. When each agent is connected to only a low number of other agents, the system exhibits orderly dynamics, and when it is gradually increased the system passes through several phase-transitions to become, ultimately, chaotic in the limit of a complete system (Choi, 2002). This level of order is important to the ability of the network to change and incorporate improvements and co-evolve with other ecosystem.

### *Dynamics*

In view of the above, because a business network consists of large number of interconnected agents, network dynamics are an inherently important phenomenon to analyze from the business ecosystem perspective. Depending on the characterization of the structure, different starting points are used to discuss the dynamics of the network.

Current research on business networks acknowledges the existence of endogenous and exogenous dynamics which can have significant consequences for the strategy advantages of actors in the network. Network theory can provide important insights to better comprehend the dynamics by explaining why firms get locked-in and locked-out from the dominant design (Gulati et.al, 2000).

From complexity science, dynamics as a result of interconnectedness are discussed based on the phenomena that arise from such interaction, which are co-evolutionary processes and non-linear processes.

### *Co-evolutionary process*

Within complexity science, networks gradually evolve from random collections of agents to more structured communities that involve interdependent species of organization in an endless reciprocal structure. Adaptation and survival are the hallmarks of this process, as are predatory and prey interactions (Gundlach, 2006). The business network interacts with its environment which creates dynamics because there is feedback between the network in terms of cooperation, competition and co-evolution with the environment (Choi et.al, 2001).

### *Non linear changes*

Behavior of a complex system, which shows non-linear behavior, stems from the complex interaction of many loosely coupled agents (Choi et.al, 2001). Small changes can lead to different future paths in the form of emergent structures, patterns and properties that arise without being externally imposed on the system. This emergence is a result of the self-organizing characteristics of a complex system, in which agents simultaneously and in parallel react on the changes. The network structure and dynamics are emergent phenomena as a result of the self-organizing system of firms from which the network is composed.

Changes are constant and interdependent in complex systems (Choi et.al, 2001). Over time, business networks evolve through different phase which are pioneering, expansion, authority/leadership, and self renewal or death, as proposed by Moore (1996a). This evolution finds its roots on biological evolution through mutation, replication, competition and adaptation. In biology, this is a slow and unconscious process driven by physical phenomena (e.g., mutation) and implemented by competitive reproductive strategies adapted to specific environmental niches (Ayres, 2004). Within an economic or business context, this mutation phenomenon is represented by invention or innovation. Invention and innovation are the results of competitive reproductive strategies of firms that would like to maintain their continuity in the business. Firms that fail to perform competitive reproductive strategies will die.

## **4.4 Performance**

Network health is influenced by the strategic actions of firms through a governance mechanism and through the same governance mechanism the health of the network will influence the performance of the firms. Iansiti and Levien (2002; 2004b) have already developed some measures of network health. They define three measures of health, namely productivity, robustness and niche creation. Yet, there are some issues on the operationalization of these measures due to problems with data

availability and access. Other proxies or workable measures can be developed by building on network theory and biological ecosystem theory.

From biological ecosystem theory, a healthy ecosystem should reflect properties of resilience, organization and vigor that sustain life systems. Vigor is measured in terms of ‘activity, metabolism or primary productivity’ which focuses on the existing organic base that helps accommodate disturbance. Organization can be assessed as the diversity and number of interactions between system components. It gives emphasis on structure and diversity. Resilience is measured in terms of a system’s capacity to maintain structure and function in the presence of stress. When resilience is exceeded, the system can ‘flip’ to an alternate state. These measures are similar to ones developed by Iansiti and Levien (2002; 2004b).

From network theory, network health can be assessed through network measures, as was done by Jimenez (2007). He operationalizes two measures as defined by Iansiti and Levien, i.e., productivity and robustness, by using structural approach in which attributes of the relationships between actors are the focus of analysis. Robustness is defined as the ability of business network to face and survive technological perturbation by means of the resilience of the network and the complexity of its internal structure. It is measured through the network measures of cohesion, density and connectivity. Productivity is defined as the ability to transform resources into value-creating activities or products. It is measured through the network measures strength of ties (i.e., trust and closeness) and embeddedness (i.e., number of ties and reciprocity). As this study has not touched on the third measure mentioned by Iansiti and Levien, niche creation, it would be useful to proceed developing niche creation measures using the same approach.

## **4.5 Governance**

Although it can be argued that it is impossible to manage a network, managers have to do it on day-to-day basis (Ritter and Gemünden, 2003). It is related to what a firm can really do to influence the network and how it can do this. Managing the network is an interesting issue considering that a firm can influence the network only to a certain extent. A lot depends on the behavior of the other actors in the network, see, e.g., Ritter and Gemünden (2003), Jones et.al, (1997), Den Hartigh and Van Asseldonk, (2004) and Van Asseldonk et.al, (2002). Den Hartigh and Van Asseldonk (2004) therefore propose to use the term *governance* instead of *management* because here the firm tries to influence a networked system of which it is not the ‘boss’.

The works on network governance is developed based on different theories such as transactions cost

economics and social network theory. Jones et.al (1997) mention that network governance is increasingly important but poorly understood. Kohtamaki et.al (2006) mention different viewpoints in network governance studies, which are:

- Markets versus hierarchies, a view based on the transaction cost theory which defines price and authority as the mechanisms of governance.
- Networks as an intermediate form between markets and hierarchies. In this interpretation, partnership is a more integrated form than a market but less integrated than a hierarchy.
- Networks as a form distinct from markets and hierarchies. In this view the governance mechanism of a network is a social one, emphasizing the meaning of shared purpose and trust between actors.
- The simultaneous use of three different mechanisms of governance which are price, authority and social governance.

Studies in business ecosystems have not said much on the governance. Moore (1996a) mentions that the most important contracts governing network relationships are community governance systems and quasi-democratic mechanisms. Moore's concept on ecosystem governance comprises markets and hierarchies. He mentions that the ecosystem internalizes the systems of firms and the markets that connect them under the guiding hands of community leaders (2006a). Iansiti and Levien (2004b) mention that ecosystems are governed by shared fate. They do not, however, discuss this guiding mechanism in depth. Vos (2006) formulates business ecosystem governance as:

1. Providing network members with an incentive and vision to strive for a common goal,
2. giving them the freedom to reach that goal on own initiatives so that their motivation is not hampered by obstruction,
3. while using steering mechanisms to ensure that their activities will reach this common goal,
4. in an effort of improving the business ecosystem's capability of coping with exogenous changes and the internal pace of innovation.

He identified four basic principles, coming from complex adaptive systems theory that can be used to conceptualize governance mechanisms, namely co-evolution, emergence, self-organization, and adaptation.

Further investigation of the four aspects and the relationships among them will enrich business ecosystem concept and is expected to provide valuable tools for managers or practitioners to understand and intervene the complex situation in its business network.

## 5. A core logic of business ecosystems

Based on the above theories contributing to the further development of the business ecosystem perspective, it can be concluded that a business ecosystem perspective will need to be firmly founded in (social) network theory and complex adaptive systems theory. Biological ecosystems theory will provide the metaphor that serves as a source of inspiration. For integrating the core aspects of the business ecosystem perspective based on different founding theories, we draw upon a concept put forward by Lengnick-Hall and Wolff (1999). A core logic describes the set of articulated principles that specify strategic goals, frames, competencies, and expectation for success. Lengnick-Hall and Wolff (1999) distinguish between capability logic and complexity logic (see table 5).

Table 5. Comparison between capability logic and complexity logic  
(summarized from Lengnick-Hall and Wolff, 1999)

Aspect	Capability Logic	Complexity Logic
Market condition	Economic setting is equilibrium oriented where changes can be intentionally engineered and often designed to reinforce incumbents who have attained desirable competitive positions.	Marketplace is a result from cumulative and collective chains of activity and reactions. Small initial differences often results in significant marketplace variety so that no individual or firm is expected to be able to determine or fully manage market conditions.
Strategic Purpose	success is achieved when firm is able to leverage its resources and competencies to achieve a sustainable competitive advantage and, thereby, establish an incontestable position in the marketplace	Success is a network of reciprocal, mutually beneficial relationships and does not require having an edge over other firms or extracting disproportionate rents. The primary strategic purpose is resilience resulting from a nurturing web of relationships
Competitive Advantage	competitive advantage is the root of value creation, is sustainable, and can be achieved by exceptional scarce, valuable, inimitable, and non-substitutable assets	Competitive advantage as defining a firm's potential relative to the overall processes and resources of the network. From complexity perspective, a firm's competitive advantage is both its contribution to the systemic enterprise and a potential attractor shaping large systemic patterns of behavior
Imitability	Preventing the imitation or appropriation of rare, valuable, and useful assets as cornerstone of creating a sustainable logic	Efforts to protect proprietary resources and knowledge are counterproductive and work to the detriment of system-wide accomplishment. Learning organizations required shared mental models, deep knowledge of important technologies and a language for sharing tacit knowledge
Time Horizon	Use calendar that reflects market and product life cycles. A long term planning horizon is both desirable and feasible	Concentrate on the cumulative effects of multiple life cycles across network of products and industries and technologies
Source of Influence	Influence is derived from controlling superior resources, or superior resource combinations that result in superior capabilities	Influence relies on shaping the system architecture which is done by triggering relationships and interactions that serve as catalysts to increase and reduce system regularity. Power comes from understanding patterns, and then intervening to change fundamental systemic attractors and processes
Nature of relationship	Relationships are built around power derived from the control, protection and appropriability of resources and assets. Key	Relationships are long-term and collaborative out of interdependence. Influence comes from developing relationships noted from reciprocity, stable patterns, and

Aspect	Capability Logic	Complexity Logic
	relationships are often built around specific ways to leverage resources	common interests. Relationships are deterministic, but non linear and dynamic
Stakeholders' focus	Concentrates on creating value for investors by enhancing the firm's stock of assets and capabilities	Dominant stakeholders is the business ecosystem community with the primary emphasize is to ensure a healthy and well-nourished ecosystem
Boundary roles	Boundary spanners act as police, shielding resources and guarding the firm's borders from inappropriate activity	Boundary spanners as ambassadors and bridge builders. Under complexity logic, every individual in the firm has important boundary-spanning responsibilities both inside a firm and beyond its borders

Interpreting this table, we propose that the business ecosystem perspective could best be classified as complexity logic. This means that strategic success is a function of a firm's talent for thriving in dynamic nonlinear systems that rely on network feedback and emergent relationships (Lengnick-Hall and Wolff, 1999). Thus, by taking complexity logic as its core logic, the business ecosystem perspective is represented by the following basic characteristics as suggested by Lengnick-Hall and Wolff (1999):

1. Individual unit or organizational success requires a healthy ecosystem.
2. The importance of unpredictable, nonlinear, and natural consequences is underscored.
3. Influence is achieved by managing initial conditions and the underlying forces, or attractors, which organize the system.
4. Systemic change is a continuous, relentless process.
5. Self-organization triggers transformation.
6. Cultural integrity is the basis for establishing relevant boundaries. Given the emphasis on community and the recognition of attractors, complexity-based strategies rely on shared values and common purposes, rather than procedures to guide behavior.

Having complexity as its core logic, the business ecosystem perspective can play an important role in the study of the relation between firms and their business networks, a field of study in which currently mainly capability logic is used. Based on differences in the aspects of strategic management between those two logics, as shown in table 5, the business ecosystem perspective can contribute by providing researchers with a broader view on the relationships between the firm and its environment and by providing practitioners with useful insights for strategy making in networks.

## 6. Conclusion, limitations and further research

In this article we took a step to mature the business ecosystems concept as a research perspective for studying the relation between individual companies and the business networks around them. We showed that, as economic activities are changing from dominantly stand-alone to networked, new perspectives are needed to study the relationships between companies and their business networks. The business ecosystem metaphor provides an interesting starting point for such a perspective. However, in its current state of development, research on business ecosystems is still lacking

consistency in definitions provided, approaches taken and aspects addressed. There is therefore a clear need to develop the business ecosystem concept from the weak metaphor it is now to a strong metaphor, or a genuine research perspective. Doing so will enable us get a better insight into the roles and strategies of companies in networks, into the nature of cooperative and competitive relationships between the companies and into the governance of business networks.

By making an overview of current research on business ecosystems, we were able to define the aspects that are core to a business ecosystem perspective, namely, the characteristics and roles (strategies) of the firms in the network, the structure and dynamics of the network, the performance of the firms and the network and, finally, the network governance. The possibility to further develop these core aspects was examined using (social) network theory, biological ecosystem theory and complex adaptive system theory. Finally, we proposed to integrate these core aspects into a comprehensive complexity/ecosystem logic by examining distinctive characteristics of a core logic, i.e. market conditions, strategic purpose, competitive advantage, imitability, time horizon, source of influence, nature of relationship, stakeholders' focus and boundary roles. In doing this, it is expected that the study of business ecosystem will create additional insights and explanatory value in strategy making.

The research in this paper has a few limitations, which provide opportunities for further research. A first limitation is that a limited number of underlying theories was used to found the core aspects of the business ecosystem perspective. In this paper we used network theory, social network theory, biological ecosystem theory and complex adaptive system theory. While we think these theories together will cover important parts of the business ecosystem perspective, it might well be worth extending the set of theories with evolutionary economics and game theory. Game theory, especially in its evolutionary variant, is a perspective to analyze how interactions between individual players affect collective outcomes of this interaction. As such, it is linked explicitly to the actions of individual players (company strategies) and to the consequences of these actions at the system level (business network). In evolutionary economics, processes of evolution of business populations are studied (business network), including the fitness or adaptability requirements on individual companies (company strategies) to survive the environmental selection forces. In further research, these perspectives should be considered to be included.

A second possible limitation is that the approach taken in this paper is essentially eclectic. The advantage of such an approach is that the broad theoretical underpinnings enable us to cover the core aspects of the business ecosystem perspective, something that might not be attainable with a singular underlying theory. A challenge is posed, however, by the necessity to re-integrate the different core aspects into a comprehensive logic. In this paper, we made a first effort to do this



under the label of complexity/ecosystem logic. In further research, this comprehensive framework needs to be further strengthened.

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