**Business Networks and Ecosystems: rethinking the biological metaphor**

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**Introduction**

Driven by technological and market changes organizations compete and cooperate, and bring firms to experiment alternative coordination mechanisms that lead to intermediate or hybrid forms of organization. During the 90s, Powell and Castells argued that networks are distinctive form of coordinating economic activity and made sense to classify as “business network” any organizational structure adopting such a coordination mechanism. Although research has made important contributions towards the understanding of business networks, further theoretical and empirical research is required to develop a better understanding of the processes underlying the structure and evolution of them.

Renewing the expectation of Marshall (1948) several authors look for inspiration in biological science, electing “the theory of ecosystems” and “the evolutionary theory” as the main biological research fields affecting social and economic science that provide innovative perspective and theoretical models.

In this work, we look forward to rethink the biological metaphor in order to explain the real relationship between business network and ecosystem in an evolutionary perspective.

**1. Business Networks as Business Ecosystems**

Castells (1996) proposed the concept of the *networked enterprise* as the organizational form that a firm would adopt to fit the conditions of uncertain and unpredictable environments. According to the same author, the strengths of the networked enterprise lie in the shift from vertical bureaucracies to horizontal enterprise enabled by the use of digital technology to connect and relate dispersed organizational nodes. In the networked enterprise, components are both independent of and dependent on the network organization and can also be part of several other networks. A network organization combines the advantage of bureaucratic organization with a structure that supports innovation.

Networks (Quinn et al. 1998) could be shaped by pointing out the nodes where knowledge is created and detained, the nodes where it is used to implement solution, and the kind of relationship that links together the different nodes. Taking into account both firm and market perspectives, the new organizational problem of the firms seems to be no longer that of granting alignment among different department objectives, but of coordinating networks of knowledge-owning firms to create added value products and services.

Inside clusters, a *co-evolution* process is emerging; it develops between the networks of localized knowledge and the trans-local knowledge networks (Doz et al. 2001), based on digital information exchange. These inter-organizational structures, defined as *virtual*
clusters, are characterized by collaboration and complementarities and by the exchange of mainly digital knowledge. The concept of space is therefore crucial.

We may extend the concept of ‘actor agglomeration’ from industrial district to business network, as the generalization of any agglomeration structure that is represented by a set of firms, linked by some sort of spatial proximity (geographical, technological or institutional).

Economists belonging to any school of thought have discussed similarities between biological evolution and economic development for more than a century (Hodgson, 1998). Basing on the premise that "human beings exist wholly within nature as part of the natural order in every respect", Jacobs (2000) argues that the same principles underlie both ecosystems and economies. In particular, the author investigates the hypothesis according to which economic life obey the same rules as those governing the systems in nature, arguing that economic life is ruled by processes and principles that people do not invent and can not transcend.

Two serious drawbacks have always constrained the rigid application of biological metaphors to the study of economic development. The first is that evolution involves no intentionality toward a specific goal, whereas economic development is driven by the satisfaction of human wants. The second is that, with the exception of the smallest levels of complexity (such as genes and microbes), different biological species do not interbreed, while human beings produce new things by relentlessly combining artefacts, skills and ideas (Basalla, 1988; De Gregori, 1985; Mokyr, 1990). In this sense, economic development is the result of individuals trying to solve problems affecting them by combining heterogeneous facts, ideas, faculties, and skills on a scale that is unparalleled in the rest of nature (Jacobs, 2000).

Even if any comparison between economic and ecologic realms has to be careful, biological ecosystems seem to provide a powerful metaphor for understanding a business network. As biological ecosystems, business networks are communities of agents with different characteristics and interests, bound together by different mutual relationships as a collective whole. Species within ecosystems are related and interact with each other as much as firms play a specific role in a business network. The fate of each living organism in the ecosystem is related to the fate of the others; cooperation and competition, as much as in a business network, are considered ecosystem characterizing phenomena.

Tansley (1935) firstly defined an ecosystem as the whole system represented by both the biological organisms and a complex set of physical factors and he correlated the ecosystem with a network of relationships. Starting from the definition by Tansley, Lindeman (1942) developed the modern approach to the ecosystem by adopting Elton’s food web model and Lotka’s thermodynamic approach (Elton, 1927; Lotka, 1925).

The first approach to business ecosystem is due to Moore (1993) who argued that a firm is not just a member of a single industry but a part of a business ecosystem that crosses a variety of industries. In a business ecosystem, firms’ capabilities co-evolve around new innovations that characterise the ecosystem itself, as the locus around which species co-evolve by exploring innovative evolutionary path.

Extending Moore’s biological metaphor and emphasizing the keystone metaphor, Iansiti and Levien (2004a) identified in keystone firms the leader and the centre of the ecosystem. They support two basic items: that the food web model is useful to describe systems of organizations as a network of mutual relationships, and that the new form of competition, the need for collaboration and the process of market co-evolution are simply explained as a results of the biological metaphor adoption.
Anyway we believe that biological metaphor proposed by Iansiti and Levien is hard to be used as an instrument of analysis for the business ecosystem for some reasons. First, it uses both thermodynamic and network theory in order to model interaction among populations and environment, while the business ecosystem perspective is not able to model the environmental conditions and can’t leverage the thermodynamic theory to build a business ecosystem theory. Second, the concept of community, as defined in biological science, is proper to define Iansiti’s own approach than the ecosystem one, since community takes care about populations relationships and evolution, and excludes environmental interaction. Third, Iansiti identifies the role of leader in keystone species that seem to have a role that is closer to the Iansiti artificial ecosystem than to the natural ones.

As a consequence, the key question is: how could we design, or at least support the creation and growth of natural business ecosystems? Although a business ecosystem may evolve toward centralized structures, moving toward what Tapscott et al. (2000) define as an aggregator model, a business ecosystem theory needs to be quite general in order to explain it as a kind of self constructed and auto organized business network. In such a context, we focus on the understanding of the rules that govern natural biological ecosystems and, as a consequence, natural business ecosystems.

2. The Evolutionary Perspective

Evolutionary perspective is the common ground for a theory of organizational change, capable of explaining the evolution of organizational models in terms of emergence and selection of new species.

Organisms play two roles in evolution. The first is the basis for most evolutionary theory and it consists of carrying genes; organisms survive and reproduce according to chance and natural selection pressures in their environments. However, organisms also interact with environments and modify at least some of the natural selection pressures present in their own, and in each other's, local environments. This second role for phenotypes in evolution is not been subject to a great deal of investigation: it is called "niche construction" (Odling-Smee 1988).

Niche construction should be regarded, after natural selection, as a second major participant in evolution. It is the process whereby organisms, through their activities and choices, modify their own and each other's niches. By transforming natural selection pressures, niche construction generates feedback in evolution in a manner that alters the evolutionary dynamic. Odling-Smee et al. (2003) developed a new approach to evolution that treats niche construction as a fundamental evolutionary process in its own right: it is called extended evolutionary theory.

In this new perspective, culture adds a second knowledge inheritance system to the evolutionary process through which socially learned information is accrued, stored, and transmitted between individuals. Tylor (1871) defined culture as “that complex whole which includes knowledge, belief, art, morals, custom and any other capabilities and habits acquired by man as member of a society”, so how could such an inextricably interwoven complex of ideas, behaviour, and artefacts evolve?

3. Evolutionary Theory and Organizational Change

The first and most influential biological metaphor applied to socio economic science was Darwinian selection on the population ecology by Hannan and Freeman (1977), that takes from the biological perspective the suggestion of the emergence of new species of
organizations that compete for resources. According to Hannah and Freeman, each organization is defined by its technology, structure, products or services, objective and people. These elements cause the organization’s survival in the environment or make it disappear because of environmental selective pressure.

The attempt to adapt the evolutionary theory as a metaphor for explaining business perspective has a strong limitation in the lack of a unit of analysis for the evolution process, as gene for biological evolution. As a consequence it is difficult to create a model describing the emergence of organizational phenotypes in the evolution processes and their fitness respect to the environmental conditions.

Nelson and Winter (1982) suggested an evolutionary model, mainly based on the parallelism between genes and routines. The Nelson and Winter Evolutionary Theory of the Firm focuses the attention on organizational routines as unit of knowledge. They consider routines as behavioural patterns that workers use during their activities, which make different one firm from the others. Partly driven by his attempt to show that Universal Darwinism (Dawkins, 1983) provides a suitable framework for evolutionary economics (Hodgson and Knudsen 2006), also Hodgson suggests that routines are like genotypes (Hodgson 2003, Hodgson and Knudsen 2003).

The routine approach can be extended separating the perspective between behaviour and thing: according to Fontana (1998) behaviour is not a thing but it is property of a thing. As a consequence, the organizational routines could represent the functions and the dynamical principles that govern the interactions among the parts of the organization. In this perspective Nelson and Winter routines became the phenotype of more complex genotypic elements that Padgett defines logic of identity.

According to Padgett (2001), organizations - social or biological - are developmental products of these founder logics, interacting with the inherent properties of the social or biological raw materials being assembled. In economic organization, these raw materials are in large part the social networks of business interaction partners, selected through trading and personnel flows.

Social and political networks have the two-fold roles of generation and regulation of markets. Recombination and refunctionality are the key elements through which organizational ideas and models are transposed from one domain to another. Social and political networks operate through negative feedback as a regulatory mechanism for transposition and reproduction, granting stability and equilibrium to the systems (Padgett and Powell, 2003).

4. Final Consideration

In the attempt to review the biological metaphor overcoming the limitations highlighted before, we considered the promising perspective come out from the studies of Fontana and Padgett.

The Fontana analysis about the relationships existing between phenotype, genotype and populations gives the opportunity for a depeening about organizational genotype, relationship about organizational genotype and phenotype, environmental influence on the emergence of organizational population.

The Padgett analysis focuses the attention on the systematic relationship between processes of organizational birth and the surrounding social and economic contexts, out of which organizations are constructed. This perspective fits organizational emergence in respect to the surrounding social, economical and political environment.
Padgett logic of identity and multiple dynamic networks represent two key issues that enable further research on business ecosystem theoretical foundation and give a fundamental contribution in order to develop an evolutionary model for business network.

References


