Business organizations' knowledge-production processes: an autopoietic approach

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Abstract

Purpose – The purpose of the paper is to explore the potential of autopoiesis theory to open up new ways to understand knowledge production in business organizations.

Design/methodology/approach – Initially essential theoretical information is presented, by reviewing the concept of knowledge-based competitive advantages in business organizations, and describing the notions of autopoiesis as a basis for the understanding of knowledge production in organizations, and micro-macro problem within the companies' structure and production. After that follows the main content of the paper, namely descriptions of processes influencing knowledge production in business organizations.

Findings – Knowledge is embedded in social practices and a local setting and it is very much tacit in nature providing then a basis for creating a sustainable competitive advantage for business organizations. A business organization's memory and production are mutual media for one another in autopoietic recursive processes.

Originality/value – Finding a viable perspective and approach with which business organizations can understand how their knowledge production takes place is an important issue. It is claimed in this paper that the idea of autopoiesis can potentially provide a new understanding for business organizations' knowledge production.

Keywords Knowledge production, Autopoiesis, Organizational memory, Observation, Languaging, Interaction, Knowledge management, Organizations

Paper type Conceptual paper

1. Introduction

Many business organizations place great dependence on continual knowledge production that leads to new or improved products and services (Nonaka and Takeuchi, 1995; Scarbrough, 2008). However, questions of knowledge and knowledge production are not easily addressed. Therefore, finding a viable view and approach through which business organizations can better understand how their knowledge production takes place over time is a very important issue.

Concept of knowledge has different definitions, depending on the discipline where it is used. Here the concept of knowledge means human understanding of a specialized field of interest that has been acquired through study and experience.

One way to categorize knowledge is whether it is tacit or explicit (Polanyi, 1966; Baumard, 1999). In this paper the focus is more on tacit knowledge that underlies many competitive capabilities. The experience, stored as tacit knowledge, often reaches consciousness in the form of insights, intuitions, and flashes of inspiration (Kulkki and Kosonen, 2001). Tacit knowledge as opposite to explicit knowledge is far less tangible and is deeply embedded into an organization's operating practices. Because tacit

knowledge is much harder to detail, copy, and distribute, it can be a sustainable source of competitive advantage (Itami and Roehl, 1987; Hatsopoulos and Hatsopoulos, 1999).

Current theories about knowledge production in business organizations are largely based on the idea of codability and transferability of knowledge between the people and across the borders (Koskinen and Pihlanto, 2008; Koskinen, 2010b). This type of thinking is based on the traditional cognitivist epistemology which means that knowledge represents an external reality (von Krogh and Roos, 1995b). However, the new autopoietic approach suggests transition from these theories to the theory of knowledge production as a creational matter, which type of thinking can potentially provide a newer explanation for a business organization's knowledge production (Koskinen, 2010a). Therefore, the goal of this conceptual paper is to describe knowledge production taking place in business organizations with the help of autopoiesis theory.

Thus, the goal of this paper is to explore the potential of autopoiesis theory to open up new ways of understanding knowledge production in business organizations. In the pursuit of this goal, the paper first describes the role of knowledge in the formation of a business organization's competitive advantage. Next, the paper deals with the theory of autopoiesis for a better understanding of knowledge production. Then the discussion deals with the stable-process problem under the title of micro-macro problem. The main content of this paper follows, namely descriptions of processes through which knowledge production takes place in business organizations: organizational memory, observation, languaging, and interaction.

2. Knowledge-based competitive advantages in business organizations
Alvesson (2001, p. 863) defines knowledge-intensive companies (e.g. business organizations) as "[...] firms where most work is said to be of an intellectual nature and where well-educated, qualified employees form the majority of the work force." Knowledge in these types of organizations is fundamentally social in nature (Canguilhem, 1991; Soo *et al.*, 2004). That is, an individual may have personal knowledge (Polanyi, 1962) that he or she values, but in order to make knowledge socially useful and accepted, it must be recognized as legitimate by social actors and institutions (Knorr Cetina, 1999).

In general, knowledge is produced within communities of practice (Wenger and Snyder, 2000; Gherardi, 2001). As a consequence, knowledge in business organizations forms a social, interpretative system (Daft and Weick, 1984; Stern and Barley, 1996) wherein knowledge is used, produced, discussed, exchanged, substituted, and so forth (Styhre, 2003). In the words of Orlikowski (2002, pp. 252-253):

> [...] knowledge is an ongoing social accomplishment, constituted and reconstituted in everyday practice. As such, knowing cannot be understood as stable or enduring. Because it is enacted in the moment, its existence is virtual, its status provisional.

In other words, knowledge in business organizations is composed of various levels that are related to one another.

A business organization sustains its competitive advantage if it resists erosion by competitors and thereby keeps a unique position that allows it to consistently outperform its competitors (Hofer, 1978; Lippman and Rumelt, 1982). As discussed by Reed and DeFilippi (1990), the question of how long a sustainable competitive advantage lasts is company-specific, but one thing is clear – it will not last forever (Barney, 1991). Thus, the question as to how competitive advantages erode through imitation is

still open. However, what appears to be clear is that tacit knowledge is very important source of creating and sustaining competitive advantage (Holden and Glisby, 2010; Baumard, 1999; Nonaka *et al.*, 2008; Koskinen, 2003).

Polanyi (1966, p. 4) begins his consideration of tacit knowledge by "[. . .] starting from the fact than we can know more than we can tell." Thus, we can, for example, almost instantly recognize a face from among a thousand, but we usually cannot explain how we recognize a face that we know. Tacit knowledge permeates our personal and work lives, enabling us to drive the car, enjoy a film, or deal with a problem situation. Thus, Polanyi stands in opposition to the objective, analytical view that sees knowledge as something human beings obtain by analysing the object as a thing that exists separately and beyond the self (Nonaka *et al.*, 2008, p. 9). Tacit knowledge is hard to transfer or verbalize partly because it cannot be broken down into particular rules or elements, and partly because it exists as an emergent quality of knowing something as a whole.

Furthermore, while tacit knowledge is a personal resource, researchers (Wenger, 1991; Brown and Gray, 1995) have found that teams as well as whole organizations can be usefully thought of as possessing knowledge that has the characteristics of tacit knowing, that is, knowledge which is hard to document but is dispersed among multiple actors who interact with each other and with the physical, cultural, and social dimensions of their task and organizational setting. Studies such as those of Brown and Duguid (1991) and Orr (1990) challenge the traditional assumptions that learning and knowing implies individual mastery, and that everything that is knowable can be made explicit.

On the basis of the discussion above, we propose:

Knowledge in business organizations forms a social system that enables the production of knowledge. Knowledge is thus embedded in social practices and a local setting and is very much tacit in nature, and provides a basis for creating a sustainable competitive advantage for business organizations (Koskinen and Pihlanto, 2008).

3. Autopoiesis as a basis for the understanding of knowledge production in organizations

In the words of Gaines (1979, p. 1), "A system is what is distinguished as a system." This means that the observer has a choice of ways to define the system that he or she intends to analyse. In other words, how the individual recognizes systems and what is seen as a system is based on his or her point of view. That is, there are evidently many types of systems that can be analysed both quantitatively and qualitatively. Therefore, we can conclude that business organizations can be regarded as systems.

Autopoiesis theory's (Maturana and Varela, 1980; Mingers, 2010) main thesis is that the components (e.g. pieces of knowledge) of a system are used to produce new components (e.g. new pieces of knowledge) and their relations so as to recreate the system. This means that an autopoietic system (e.g. business organization) is self-productive (Biggiero, 2001), which, in turn, means that the components accumulated by the system themselves affect the components of the system. In the words of Seidl (2005b, p. 22), "All processes of autopoietic systems are produced by the system itself and all processes of autopoietic systems are processes of self-production."

The question of whether human social systems such as business organizations can be regarded as autopoietic systems has been discussed quite extensively, and different

authors (Capra, 1996; Morgan, 1996; Luhmann, 1986; Zeleny, 1981; Mingers, 2010) have proposed various answers. The central problem is that autopoiesis theory has only been defined precisely for systems in physical space and for computer simulations in mathematical spaces. As a result of the inner world of concepts, ideas and symbols that arise with human thought, consciousness and language, human social systems exist not only in the physical domain but also in a symbolic social domain.

However, autopoiesis theory can be understood as a relational theory (Maula, 2006; Koskinen, 2010a). The focus and level of observation determines whether a system, such as a business organization, must be regarded as autonomous or controlled. The autonomy and control approaches complement each other. A given system (i.e. business organization) may be seen as an autonomous totality, while simultaneously its components may be seen as input-process-output systems from the control perspective (Varela, 1979). Thus, it is possible for a business organization to be regarded simultaneously as an autonomous, autopoietic system capable of self-production, as well as a controlled system. Here, a business organization is seen as an autonomous totality.

The relationships among the components include the process of interaction. A particular complex of such processes, assembling the components into identifiable unity, is here referred to as its identity. The identity of an organization manifests itself in a given environment so that it forms a particular space-temporal arrangement of components which realize the organization as a concrete entity. This is referred to as the structure of the system. Thus, an autopoietic system (e.g. a business organization) is a unity of its identity and structure (Magalhaes and Sanchez, 2009).

Autopoiesis theory is closely associated with Maturana's (1980, 1988) theory of the observer (Brocklesby, 2009). This brings into the spotlight people's actual experiences and explanations as these are actively constructed in social networks. In this construction language is not an abstract symbolic system of communication in an independently existing world; rather it is a relational phenomenon associated with the manner in which people live together in concrete settings (von Krogh and Roos, 1995b). In other words, language is the primary mechanism through which people construct their realities, with all aspects of organizational life arising through a continual process of production and reproduction.

Moreover, compared with other theories of knowledge, autopoietic epistemology which is based on autopoiesis theory provides a fundamentally different understanding of the input coming from outside a system (Hall, 2005). Input is regarded not as knowledge but as data, i.e. knowledge is data put into a certain context. This means, for example, that knowledge cannot be directly transferred from an individual to another individual, because data have to be interpreted by the receiving individual before its becoming knowledge. For example, when a teacher delivers a speech two students build different knowledge. The transmission by the teacher is the same for both, but the knowledge produced is different: knowledge therefore cannot be transmitted but only created or produced (Vicari and Troilo, 1999). That is, the only way to produce new knowledge is to utilize existing knowledge.

Furthermore, according to autopoietic epistemology, information does not equal knowledge, but it is a process that enables knowledge production and sharing to take place. von Foerster (1984, p. 193) states that "[. . .] information is the process by which knowledge is acquired." That is, articles – for example this paper, books, manuals, memos, computer programs, etc. – are data not information.

On the basis of the discussion above, the following proposition is set:

P1. Autopoietic systems (e.g. business organizations) are systems of a certain identity, independent of their components (e.g. pieces of knowledge) but dependent on their interrelations. Thus, over time an autopoietic system changes its components but maintains its identity.

The complexity of business organization demands that we are able to analyse at different levels and that we relate processes at different levels to one another. Therefore, the next section deals with these issues.

4. Micro-macro problem

According to the traditional stable-process problem (i.e. macro-micro problem), the business organization's structure (i.e. stable) and production (i.e. process) cannot interact (Bakken and Hernes, 2002a). Conceptually, they both remain distinctly different entities, and the differences stem from epistemologically different theoretical projects. However, the complexities of business organizations demand that we are able to analyse them at different levels –, i.e. the organization's structure and production levels – and that we are able to relate processes at different levels to one another.

Thus, on the basis of autopoiesis theory, the interaction between process (i.e. production) and stability (i.e. structure) takes place through the operation referred to as recursivity (Luhmann, 1995). Recursivity is that which permits the reproduction of interactions over time. Having a recursive view of a business organization implies dealing with the question of how this organization persists and develops (Koskinen, 2010c). For example, recursivity takes place when the knowledge needed by the organization is offset against the organization's present knowledge, which again enables new knowledge to occur (Koskinen, 2010a). This means that an organization's knowledge is developed by production which, in turn, influences future production. Furthermore, according to Giddens (1984), recursivity occurs in the field of tension between structure and actions;, i.e. a business organization's structure and production, respectively. Hence, a business organization's structure and production become mutual media for one another in recursive processes.

In practice, people prefer to think that there is a level beyond the production (e.g. organization's structure) that provides a context for production. However, this level is not a level unaffected by production in the company. Instead, this other level is both produced by production and influences production in turn. Recursivity refers principally to the interaction between production and the context for production (Bakken and Hernes, 2002b).

For example, a business organization's knowledge structure (i.e. organizational memory) is created through production, i.e. it forms the context within which production takes place. Although the organization's knowledge structure was created in the past, it is formative for future production. It is, therefore, impossible to understand the future without understanding the past, as the past is written into the future. Seen in this way, a business organization's knowledge structure may constitute constraints, partly because it is created in the past and partly because it put limits on potential production (Koskinen, 2010a).

Thus, when a business organization's new production is planned, there is a repertoire of possibilities open to the people involved. This repertoire is shaped by previously

completed production. Whether it is expected or unanticipated, it serves to inform new production. Hence, the idea of recursivity represents explanatory potential for relationships between the organization's knowledge structure and production within the organization in ways that are not possible with singular epistemologies. This takes place by considering these organizations as wavering between change and no change, and understanding relationships among the past, the present and the future so that new insights may be gained (Bakken and Hernes, 2002b).

On the basis of the discussion above, we propose:

A business organization serves to bind different constituents (e.g. pieces of knowledge forming an organizational memory) over time. This means that it is inconceivable that the business organization can exist without such bonds. The organization presupposes interaction around these constituents and provides the essential stabilization of expectations among those who take part in these activities. It is equally inconceivable that a business organization should exist without production. In the absence of production, there is nothing to inform organizations, so they would not be able to reproduce themselves. Thus, a business organization's knowledge structure (i.e. organizational memory) and production are mutual media for one another in recursive processes.

Thus, having a recursive view of a business organization implies dealing with the question of how this organization persists and develops. Therefore, the following sections deal with macro and micro processes that offer means for better understanding of business organization's change as well as continuity.

5. Macro and micro processes

In a larger time-space entity, such as in a business organization (i.e. autopoietic system), the organization's structure evolves slowly and takes hold through production processes (Levitt and March, 1988). This means that within the structure, micro processes are at work, referred to by Weick and Roberts (1993) as micro changes (i.e. micro processes). Thus, micro processes take place amid the larger movements in business organizations, and may connect to the more overall organizational unfolding in a variety ways. Hernes (2004) suggests that stable organizational spaces (i.e. structure) serve as a harbour for emergent processes providing resources to emergent micro processes.

In practice, there are numerous different micro processes that affect a business organization's knowledge structure. However, because we are especially interested in knowledge production, only three essential processes, namely observing, languaging, and interaction, are selected for the following analysis. Then, the business organization is seen to consist of macro and micro processes in a way in which organizational memory (i.e. knowledge structure) is a macro process (i.e. level beyond knowledge production), and observing, languaging, and interaction are micro processes (i.e. processes with the help of which knowledge production takes place) which together recursively interact with the organizational memory (Figure 1).

However, organizational memory (macro process) and micro processes (i.e. observing, languaging, and interaction) evolve differently over time. Organizational memory, although being a process, evolves slowly. Therefore, it can be considered to be stable compared with the fast micro processes which evolve quickly. Further, as mentioned above, these two types of processes interacts recursively, i.e. organizational memory evolves by knowledge production which, in turn, influences future knowledge production.
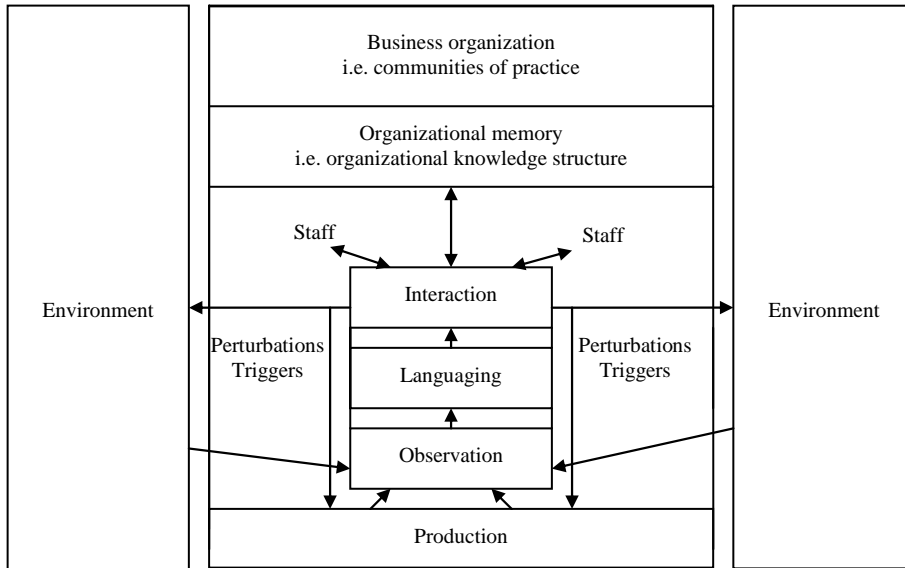
| Business organization |
| i.e. communities of practice |
| Organizational memory |
| i.e. organizational knowledge structure |

Staff   Staff

Interaction

Languaging

Observation

Environment   Perturbations   Perturbations   Environment
                   Triggers   Triggers

Production

5.1 Organizational memory (macro process)

Nowadays knowledge is the key asset of business organizations (Edvinsson and Malone, 1998). Organizational memory extends and amplifies this asset by capturing, organizing, disseminating, and reusing the knowledge produced by its employees (Schatz, 1991).

Thus, in the opinion of Schatz (1991), organizational memory provides knowledge that enables an organization to function effectively. This means that in order to carry out their work, people working for business organizations frequently need to learn things already known in these organizations (i.e. they need to acquire and assimilate organizational memory). This means, in turn, that people both draw on the organization's memory and contribute to it. The more effectively they carry out these actions, the more effective they are and the more effective their organizations will be (Cohen and Bacdyan, 1994; Huber, 1999).

According to Levitt and March (1988), conceptions of knowledge production presume that the lessons of experience are maintained and accumulated within routines despite the turnover of personnel and the passage of time. That is, rules, procedures, beliefs and so on are conserved through systems of socialization and control. They are retrieved through mechanisms of attention within a memory structure. Such organizational instruments not only record history but shape its future path, and the details of that path depend significantly on the processes by which the memory is maintained and consulted.

Literature (Walsh and Ungson, 1991; Cross and Baird, 2000; Paoli and Prencipe, 2003) mentions numerous different types of repositories (e.g. minds or world views of people and company databases) which form an organizational memory, and where organizational knowledge is maintained and into which newly produced knowledge is deposited for later use by other people. However, databases only complement the personal networks of those seeking answers to problems. No matter how functionally robust the search, a person's network of human relationships often determines which

knowledge he or she can access. People usually take advantage of databases only when colleagues direct them to a specific point in the database. Rather than engaging in an extensive search through an organization's repository of knowledge, employees turn to friends and peers to learn where to find relevant knowledge.

Thus, experiential knowledge, whether in the tacit form or in formal rules, is recorded in an organizational memory (Brooking, 1999). That memory is orderly, but it exhibits inconsistencies and ambiguities. Some of the contradictions are a consequence of inherent complications in maintaining consistency in inferences drawn sequentially from a changing experience (Brooking, 1999). Furthermore, organizational memory is not just a facility for accumulating and preserving but also for sharing knowledge. As knowledge is made explicit and managed it augments the organizational intellect, becoming a basis for knowledge production:

> Given the nature of organizations and the competitive environment within which they exist, organizational learning and the accumulation of knowledge will be a source of immediate health as well as long-term survival (McMaster, 1995, p. 113).

However, business organizations vary in the emphasis placed on formal routines. Craft-based organizations rely more heavily on tacit knowledge than do bureaucracies (Becker, 1982). Organizations facing complex uncertainties rely on informally shared understandings more than do organizations dealing with simpler, more stable environments (Ouchi, 1980).

On the basis of the discussion above, we propose:

> Organizational memory is the body of data and knowledge relevant to a business organization's existence. However, relatively little is known about the details by which organizational experience is accumulated into a organizational memory, but it is clearly a (macro) process that yields different kinds of micro processes.

5.2 Observation (micro process)
If there is anything like a central intellectual fascination in this century it is probably the discovery of the observer (Baecker, 1996, p. 17).

Spencer Brown (1979) suggests treating observation as the most basic concept for any analysis. As a concept it is supposed to be even more basic than, for example, that of knowledge or knowledge production *per se*. This means, of course, that the term observation is not used in its usual sense as referring merely to optical perception. Instead, observation is used as an abstract concept referring to any operation from communication to thought.

Thus, the concept of observation does not focus on the object of observation but on the observation itself as a selection of what to observe (Latour, 1986). In this sense, the underlying question is not: what does an observer observe, but how does an observer observe; how is it that an observer is observing that which he or she is observing, and not observing something else (Seidl, 2005a).

Every observation is construed from two components: a distinction and an indication (Luhmann, 1995). An observer chooses a distinction with which he or she demarcates a space into two spaces (i.e. states or contents). Of these two states he or she has to choose one which he or she indicates. That is to say, the observer has to focus on one state, while neglecting the other. It is not possible to focus on both simultaneously. In this sense, the relation between the two states is asymmetrical (Cooper, 1986; Chia, 1994).

The real world gives the subset of what is and the product space represents the uncertainty of the observer. The product space may therefore change if the observer changes and two observers may legitimately use different product spaces within which to record the same subset of actual events in some actual thing. The constraint is thus a relation between the observer and the thing. The properties of any particular constraint will depend on both the real thing and on the observer. Therefore, a substantial part of the theory of organization will be concerned with properties that are not intrinsic to the thing but are relational between the observer and the thing (Ashby, 1968).

As the autopoietic process is not directly accessible to anything or anybody except the system, it is only open to observation and any characterization of an autopoietic system can only be given from the standpoint of an observer (von Foerster, 1972). An observer, or observer-community, is "[...] one or more persons who embody the cognitive point of view that created the system in question, and from whose perspective it is subsequently described" (Varela, 1979, p. 85).

On the basis of the discussion above, the following proposition is set:

P2. Observation is in itself an operation of an autopoietic system (i.e. business organization). It is the people working for organization who observe the events. The events they describe, as well as the differences between them, are the results of the relations the people have established between the parts of their experiences (von Krogh and Roos, 1995b).

5.3 Languaging (micro process)

> We human beings are human beings only in language. Because we have language, there is no limit to what we can describe, imagine, and relate. It thus permeates our whole ontology as individuals: from walking to attitudes to politics (Maturana and Varela, 1987, p. 212).

In the words of Sorri and Gill (1989, p. 71): "The language we use influences how we experience our world and thus how we know our world."

Through language we name, and constantly bring forth and ascribe significance to, certain aspects of the world (Taylor, 1985; Winograd and Flores, 1987; McKenzie and van Winkelen, 2004). When our language is crude and unsophisticated, so are our distinctions and the consequent judgements. The more refined our language, the finer our distinctions. Our attempt to understand and act on reality is simultaneously enabled and limited by the cultural tools we employ – with language being one of the most important (Vygotsky, 1978; Wertsch, 1998). An individual untrained in a particular activity has only a rule-based, undifferentiated outline of it in mind, rather than a set of refined distinctions (Dreyfus and Dreyfus, 1986).

Further, Weick *et al.*'s (2005) sense-making analysis corresponds somewhat to what is called the linguistic turn in organization studies (Alvesson and Kärreman, 2000), in that his analysis emphasizes the interactive talk and the resources of language in organizing processes. Weick *et al.* (2005) suggest in particular that sense-making is an issue of language, talk and communication, whereby situations, organizations and environments are talked into existence (Hernes, 2008).

Indeed, our linguistic distinctions are not isolated but exist "[...] in the network of structural couplings that we continually weave through languaging" (Maturana and Varela, 1987, p. 234). Meaning arises as a pattern of relationships among these linguistic distinctions, and thus we exist in a semantic domain created by our languaging.

Self-awareness arises when we use the notion of an object and the associated abstract concepts to describe ourselves. Thus, the linguistic domain of human beings expands further to include reflection and consciousness.

Over time, organizations develop their own distinct domains of language (von Krogh and Roos, 1995a; Teubner, 1991). There are two explanations for this. First, the obvious explanation is that languaging may be understood as the stuff that the organization is made of. By introducing the concept of organization, people linguistically distinguish it from something else (i.e. the organization-environment distinction; Fiol, 1989). Hence, the emergence of an organization presupposes languaging (Blackler *et al.*, 1998). Second, the broad linguistic distinction of organization-environment allows organizational members to make finer linguistic distinctions (Weick *et al.*, 2005). These basic distinctions allow them to coordinate their other linguistic distinctions given the concept of the organization. For example, the term customer requires the environment-organization distinction. Then, it is possible to understand a domain of language as tradition. In the process of languaging an organizational tradition is formed. This tradition will affect languaging, or in the words of Varela (1979, p. 268): "Everything said is said from a tradition."

Thus, given the variability of language, it is meaningful to speak of organizational languaging (von Krogh and Roos, 1995a, b). Organizational languaging presupposes organizational knowledge and gives rise to distinctions that form an integral part of the concept of organization. Organization has its tradition through which new conversations can take place. It demands that its members continue languaging in order for it to survive, or in other words, continue its autopoiesis (von Krogh and Roos, 1995b).

On the basis of the discussion above, we propose:

Language and languaging are useful interpretative lenses through which to understand knowledge production within business organizations. This is because they act as devices for people to make sense of past events and actions (Riessman, 1993), and to provide legitimacy and accountability for their actions (Currie and Brown, 2003; Czarniawska, 1997).

5.4 Interaction (micro process)
Interaction is a kind of action that occurs as two or more objects have an effect upon one another. The idea of a two-way effect is essential in the concept of interaction, as opposed to a one-way causal effect. A closely related term is interconnectivity, which deals with the interactions of interactions within systems: combinations of many simple interactions can lead to surprising emergent phenomena (Stromer-Galley, 2004).

In the opinion of Stromer-Galley (2004), the concept of interaction is confusing because it refers equally to different phenomena. One can identify interaction between people, between people through mediated channels, between people and computers, and between computers through software, hardware and networks. The first two are a type of social interaction that occurs between people. The last two are a type of interaction that occurs between people and computer networks. We are here interested in social interaction, because it is seen to be one of the main processes by which knowledge production in business organizations takes place over time.

According to Rafaeli (1988), interaction is an expression of the extent that in a given series of communication exchanges, any message is related, to the degree to which previous exchanges refer, to even earlier transmissions. Interaction, Rafaeli (1988, p. 110)

contends, is a "[...] natural attribute of face-to-face conversation," but can also refer to mediated interaction between people. Thus, interaction is not simply reaction, but rather reciprocity, wherein participants in the exchange can turn-take and reverse roles freely: "It is a process-related construct about communication" (Rafaeli and Sudweeks, 1998, p. 175). In Rafaeli's (1988) conceptualization, then, interaction is not a characteristic of a medium.

A business organization may exist independently of particular individuals, but it is important to understand that people working for an organization need to acquire knowledge in performing their duties. However, according to autopoietic epistemology, interpretations of events, problems and solutions vary among individuals. This means that organizational interpretations are made possible through interaction and the sharing of people's interpretations. With the help of this interaction, organizational interpretations transcend the individual level of interpretations (Koskinen and Pihlanto, 2008).

On the basis of the discussion above, the following proposition is set:

P3. Interaction plays a ubiquitous role in the knowledge production of business organizations.

6. Discussion and conclusions
Most fundamentally this paper is inspired by the autopoiesis theory and the processes by which business organizations' knowledge production takes place.

Knowledge is produced within communities of practice, i.e. within business organizations in our case. That is, knowledge in these organizations forms a social, interpretative system wherein knowledge is used, produced, discussed, exchanged, substituted, and so forth. Therefore, we conclude that knowledge in business organizations forms a social system that enables the production of knowledge. Knowledge is thus embedded in social practices and is very much tacit in nature providing then a basis for creating a sustainable competitive advantage.

As said above, theories about knowledge production in business organizations are largely based on the idea of codability and transferability of knowledge. This type of thinking has been based on the traditional cognitivist epistemology which means that knowledge represents an external reality. However, autopoiesis (autopoietic epistemology in particular) suggests transition from these theories to the theory of knowledge production as a creational matter, which type of thinking can provide a new explanation for a business organization's knowledge production.

Thus, according to autopoietic epistemology, the business organization's knowledge production does not depend on an input-output relation with its environment. This means that everything the system needs for self-production (i.e. autopoiesis) is already in the system. Therefore, we conclude that business organization's knowledge structure determines which perturbations are allowed to enter the system and what are the available changes in the existing knowledge structure at a given point in time.

According to the traditional stable-process problem, the business organization's structure and production cannot interact. However, on the basis of autopoiesis theory, the interaction between process and structure takes place through the operation referred to as recursivity. Recursivity, as explained above, is that which permits the reproduction of interactions over time. Having a recursive view of a business organization implies dealing with the question of how this organization

persists and develops. Thus, we conclude a business organization's knowledge structure and production are mutual media for one another in recursive processes.

Business organization's knowledge production consists of macro and micro processes in a way that organizational memory is a macro process, and observing, languaging, and interaction are micro processes which together recursively interact with organizational memory. Thus:

- *Organizational memory (macro process)*. Storage of data and knowledge in organizational memory is highly influenced by the pattern of retention. This means that the stored data and knowledge highly influences forming and managing collaborations. However, it is important to note that organizational memory does not always replicate past events in an exact manner. That is, the histories remembered may only be the impression of a specific event. Nevertheless, we conclude that organizational memory (i.e. organizational remembering) is the body of knowledge relevant to a business organization's existence.

- *Observation (micro process)*. Observation is used as an abstract concept referring to any operation from communication to thought. In the words of Ashby (1968), a substantial part of the theory of organization will be concerned with properties that are not intrinsic to the thing but are relational between the observer and the thing. Therefore, we conclude that the content of observation may change if the observer changes. That is, the events the people describe, as well as the differences between them, are the results of the relations the people have established between parts of their experiences.

- *Languaging (micro process)*. A domain of language is dynamic because it changes based on the experiences of the organizational members that help generate it. Thus, language is a process, not a fixed stock or an asset. Languaging describes the processual characteristics of what people do when they coordinate their behaviour through speaking. Thus, we can conclude that language and languaging are useful interpretative lenses through which to understand a business organization's knowledge production.

- *Interaction (micro process)*. The production of knowledge in business organizations is not only about processing data. That is, it also requires that the subjective views, intuitions and inklings of the individual workers are presented, tested and taken into use. These subjective views and intuitions are very much tacit knowledge in nature, and are mainly acquired and transformed into new knowledge by informal face-to-face interaction. Therefore, we conclude that interaction plays a ubiquitous role in a business organization's knowledge production.

Finally, the above-mentioned macro and micro processes continuously and recursively interact with each other. In that way knowledge that is produced is stored in a business organization's organizational memory, which, in turn, affects organization's future production. Therefore, it is possible to conclude that with the help of the concept of autopoiesis including the above described processes, we can better understand how a business organization's knowledge produced in the past, influences its current and future actions.

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