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**EPISTEMOLOGIES OF COMPETENCE RELATED KNOWLEDGE
A System-theoretical analysis**

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ABSTRACT

The purpose of this study is to examine the multiple views of knowledge and competence in organizations at different levels that cause indistinctness in competence management and to find out how competence related knowledge is achieved at different organizational levels. The objective is thus to bring underlying epistemologies of knowledge and competence into the academic discussion and further examine how they are expressed in practice.

In the theoretical part of this study system theories and their use in management and organizational studies are examined. Open-system, connectivist and autopoietic approaches are clarified and their theoretical implications in organizational studies are presented. Also, the role of knowledge and its management in organizations is discussed, the vast field of knowledge management is presented and cognitivist, connectionist and autopoietic ways to conceptualize knowledge are considered. After a theoretical review a theoretical construct was formed and empirical findings were compared to it. This study was carried out in four Finnish companies and 11 persons from different organizational levels were interviewed in summer 2009. The methodology of this study is qualitative and empirical data was collected by using semi-structured interviews. In the analyzing phase the transcripts were carefully read, coded and further analyzed.

As a result of this study different approaches to knowledge and competence could be found in different organizational levels. The supervisor level was found to achieve knowledge in everyday work in own unit. The HR level acted as a bridge builder in organizations and gathered knowledge through networking. The strategic management level created knowledge in strategy making process and focused on strategic competences. These findings were compared to the formed theoretical construct. Some distinctions could be made, autopoietic, connectionist and cognitivist characteristics were all found in the examined functions, but more research in the area is needed and thus future research suggestions are presented.

KEYWORDS: Epistemology, knowledge, competence, system, autopoiesis, complexity

1. INTRODUCTION

As we continue living in a society where knowledge plays increasingly big role (see for example De Geus 1997: 15–21), organizations struggle to excel in every level, from strategic management to individual employee. Competences in these levels are built on knowledge, and use of this knowledge forms the basis of the organizational system. As many past approaches to knowledge and competence are focused on a narrow area, system theories take a different position and approach phenomenon from a holistic angle. However, understanding of knowledge differs between individuals and organizations, which makes competence building and developing difficult. Theories of organizations and management are based on different assumptions which affect on how we see organizations and knowledge. Thus, understanding different ways to see organizations helps us to overcome the problems caused by different views. It is said that dealing with competing viewpoints is one of the key competencies that needs to be developed as a basis for effective management (Morgan 1997: 8).

Underlying assumptions can be examined with the aid of the concept of epistemology. The word epistemology comes from the Greek words *episteme* (knowledge) and *logos* (theory). This theory of knowledge deals with the questions of how individuals come to achieve meaning and thereby knowledge about the reality in which they live, how is this knowledge constituted and under what conditions can the knowledge achieved be claimed as true (Sandberg 2005: 48). In organizational setting, epistemology affects on our understanding of characteristics of management and organizational studies and affects on how we see different processes and phenomena studied in the fields of strategic management and organizations (Von Krogh & Roos 1995: 7–8). Organizational epistemology can be interpreted to be constituted by following set of perspectives, theories and concepts related to following issues (Von Krogh & Roos 1995: 10):

1. How and why individuals within organizations come to know?
2. How and why organizations, as social entities, come to know?
3. What counts for knowledge of the individual and the organization?
4. What are the impediments to organizational knowledge development?

Many theories, models and concepts have been created in order to describe the nature, structure and the way of behavior of organizations that have been more successful than

others. Competence, capabilities, intangible assets and knowledge are some of the key concepts that have been presented as the main factors in creation of competitive advantage and different lines of strategic thought have derived from those concepts. Depending on the underlying assumptions of researchers and practitioners, the focus of these different streams has altered.

The new winds in the field of systems theory may provide solution for the disconnectedness of these management and organization theories. For example Löfsted (2001) examined eight research papers about competence development in organizations and found out that systemic models, methods and approaches can provide new insights in the field of competence development in SMEs. Sundberg (2001) states that it is impossible to affect directly into one's individual competence, it is only possible to offer tools and environment and act as a catalyst, and presents a holistic and systemic approach to competence development. Paucar-Caceres and Pagano (2009) compared systems thinking and different system methodologies articles to articles in the area of knowledge management and concluded that they seem to share similar conceptual grounds and the dialogue between these two management fields enrich each other. McElroy (2000) states that communities of knowledge management, organizational learning and systems thinking, and complexity theory are getting closer to each other, and each of those groups has something to offer that the other two need. Finally, Luoma (2006) has studied internal dynamics of organizations and presents a framework for management development from complex adaptive systems point of view, and concludes that it offers a rich foundation for management development, without forgetting older management theories and ideas.

System approaches offer holistic views of organizations, which encompass all the different functions, processes, people and their relationships. As the role of knowledge in organizations increases constantly, new system theories are presented to complement the older ones. The theory of complex adaptive systems derived from the studies of human brain and artificial intelligence, or the theory of autopoiesis, general systems theory based on the studies of cellular life, emphasize the role of knowledge and learning and can be proven to be useful.

So it is presented (Venzin, Von Krogh & Roos 1998: 36) that different personal epistemologies affect how we categorize knowledge and there are three reasons why epistemological assumptions should be discussed: to match epistemological assumptions to practices in organizations, to understand different epistemologies which rise from dif-

ferent contexts and the ability to recognize different epistemologies facilitates us to choose and apply the most appropriate one. Further, authors provide three different epistemologies based on the works of Varela, Thompson and Rosch (1991) and Von Krogh and Roos (1995). These epistemologies, cognitivist, connectionist and autopoietic will be discussed later. Even if this distinction between different epistemologies is not always easy to make, it still provides a tool for understanding the differences.

1.1. Research problem

Multiple views of knowledge and competence in organizations in different levels cause indistinctness in competence management. The contribution of this study is to provide clarity of different epistemologies in the most important functions in the organizations from competence and knowledge management perspective. Moreover, the purpose of this study is to find out how competence related knowledge is achieved in different organizational levels.

The main research question in this study is:

(1) How and why the most important actors in organization's competence management system come to know?

The following minor questions are presented in order to reach the conclusion for the main question:

- How organization is understood in the context of competence management from the perspective of system theories?
- How competence is understood in organizations?

1.2. The structure of the study

The first chapter gives background information for the study by presenting the study subject. Previous literature from the researched area is also presented briefly. Research problem is defined more specifically and overlook for the study is presented. Second chapter examines organizations as a system. It provides an overview of systems litera-

ture and clarifies the systems thinking movement. The purpose of this chapter is to clarify the basic assumptions on which different views of organizational competence systems are built. In chapter three, knowledge and its meaning for organizations are discussed. In chapter four research methods and the process of data analysis are presented. Respondents are also introduced. Chapter five presents the findings of this research and in chapter six conclusion of this study is presented, contribution of the study are examined and future research propositions are suggested.

2. ORGANIZATION AS A SYSTEM – THEORETICAL PERSPECTIVES

Systems theories started their development around year 1950. A push for this movement was the publication of important papers in the areas of systems of control, the development of computer language and cognitivism. As attention previously was in understanding parts of which system was composed, now it shifted to interaction of subsystems which formed system. The new theories took three main currents: general systems theory, cybernetics and systems dynamics. Engineers developed further cybernetics and systems dynamics, whereas biologists were more interested in biological control mechanisms and developed general systems theory. These streams are the basis of the current dominant management discourse, especially cybernetics. (Stacey, Griffin & Shaw 2000: 64.)

From the 1950s to 1970s systems thinking achieved the position where it was the most important influence to management sciences. There was a wide consensus in the field of practitioners and scientists about what system consisted of. However, systems thinking was dominated by positivistic and functionalistic characteristics view of systems, so in 70s and 80s it became a target for increasing criticism from practitioners and theorists. (Jackson 2000: 3.)

For example, Katz and Kahn's (1966) *social psychology of organizations*' presented organizations as open systems, taking general system's theory as their starting point. Kast and Rosenzweig (1974) presented an open system approach to management and Lippit (1982) took a systems approach to organizational renewal. Further, especially sociology and organization theory were areas where critique against hard systems thinking rose. So, in 1980s new approaches were born, such as soft systems thinking and critical systems thinking, which were contradictory against the more traditional system theories (Jackson 2000: 3). In 1990s systems thinking got a new start: chaos and complexity theories became popularized, Senge's *Fifth discipline*, based on systems dynamics, acted as an igniter of learning organization stream and Luhmann's interpretation of Maturana and Varela's concept of autopoiesis got more attention in areas such as family therapy, sociology and law (Jackson 2000: 4).

Jackson (2000) presents four main systems approaches in prevailing literature. Functionalist system approach is interested in the relationships and laws that govern systems parts and subparts. By using the methods taken from natural sciences, these systems can be optimized to adapt and to survive. However, epistemologies differ among functional-

ists (Jackson 2000: 107). Some take positivist position and claim that empirical observation of the system reveals the laws between systems parts governing its behavior. Others take structuralist view and say that it is necessary to describe processes and structures at deeper level because these are the ones that causally create the observable phenomena. Hard systems thinking, system dynamics (Senge), organizational cybernetics (Beer), living systems theory, autopoiesis and complexity theory are streams derived from this line of thought. The interpretive systems approach, (Jackson 2000: 211–290) commonly referred as soft systems thinking, focuses on people instead of technology, structure and organization. Its primary area of concern is perceptions, values, beliefs and interests. It accepts that there are many perceptions of reality which can cause conflicts, and tries to offer solutions, methodologies, methods, models and techniques for these kinds of problems professionals face at work. Interactive management (Warfield), social system design (Churchman), strategic assumption surfacing and testing, SAST (Mason & Mitroff), social system sciences, S³ (Ackoff), soft system methodology, SSM (Checkland), soft systems thinking (Senge) and the system of systems methodologies are examples of interpretative systems streams. For example Senge (1990: 73) sees the main idea of systems thinking in the shift of mind, seeing interrelationships rather than linear cause-effect chains, and seeing processes of change rather than snapshots.

Table 1. Four main systems approaches (based on Jackson 2000).

	Functionalist	Interpretative	Emancipatory	Postmodern
Focus:	Relationships and laws that prevail between system's parts	Subjective perceptions, values, interests and beliefs	Inequality between groups in society	Ensuring diversity and emphasizing creativity

The emancipatory systems (Jackson 2000: 291–329) approaches do not believe in current social order and try radically to change it. According to this view, some groups in society are benefitting at the expense of other groups, which are dominated or discriminated. These groups are based on class, race, gender, sexual orientation, age, capability or other features. The postmodern approach (Jackson 2000: 333–357) in general seeks to reclaim conflict and ensure that marginalized voices are recognized and heard. It does this through methods like deconstruction and genealogy. As interpretive systems approach tried to seek order through accommodation and consensus, postmodern approach

promotes novelty and disorder. It is said that even though postmodernism and systems thinking are hard to fit together, they can still collaborate by using systems methods, techniques and models in the spirit of postmodernism, or by using tools and methods offered by postmodernism to assist systems practitioners (Jackson 2000: 335).

Mingers (1997) states that different methodologies in organizational problem solving and intervention that have mainly been developed in the domains of operational research (OR), systems thinking and information systems, are implicitly or explicitly based on particular philosophical assumptions of the nature of organizational world and appropriateness of various forms of action. These *paradigms* can be divided into hard (positivist), treating world as an objective reality, soft (interpretivist) focusing on the meaning and interpretations of human organizations and critical, accepting both soft and hard methodologies but emphasizing the oppressive and inequitable nature of social systems. (Mingers 1997: 1–2.)

Ståhle (1998: 42–43) makes a different distinction between systems and has found three paradigms on which different streams of systems thinking are based. First paradigm concerns closed, mechanistic systems, and its aim is to “*explain and define natural laws and principles and predict events conforming to the formulated theories*”. Its roots are in mechanistic, Newtonian perspective and for example early cybernetics can be put in this class. Second paradigm concerns open systems and the main focus is on the relationships and interactions with their environment. Equilibrium, a stable state of system is considered ideal. Theories derived from general systems theory go in this category, although some advanced views show features that belong to the third paradigm. Third paradigm focuses on internal or spontaneous dynamics of systems and it is based on Edward Lorenz’s work on chaos and it has similarities to complexity research. Also, Ilya Prigogine’s work on self-organization and Maturana and Varela’s work on autopoietic systems are one of the greatest theoretical contributors to this paradigm. Further, concepts such as discontinuity, non-determinism and non-locality from quantum physics offer some theoretical insights.

Table 2. Different paradigms on systems (Ståhle 1998: 43).

Paradigm	Originator	Type of system	Research interest	Operative interest
1.closed systems	NEWTON	Static Deterministic	PRINCIPLES LAWS	Predicting Controlling

		Mechanistic		
2. Open systems	von BERTALANFFLY	Near equilibrium Equifinal Living	FEEDBACK PROCESSES	Steering Sustaining
3. Dynamic systems	LORENZ PRIGOGINE MATURANA VARELA	Far-from-equilibrium Uncontrollable Emerging	SPONTANEOUS ORGANIZATION	Understanding and cooperating with natural environment

Ståhle (1998: 44) continues by saying that depending on paradigm the starting points and focus on research are distinctively different and the unclear identification on which paradigm research is based causes obscurity and confusion. Moreover, she concludes that as area of systems research has grown so large, some identification is necessary based on the purpose of research. None of the above mentioned paradigms are not necessarily contradictory, they just provide different dimensions and characteristic of system.

Depending on the system school, a system can be defined in many ways. Skyttner (1996) presents some definitions found on literature, such as Weiss's "*a system is anything unitary enough to deserve a name*", Boulding's "*a system is anything that is not chaos*" and Churchman's "*a structure that has organized components*", frequently used common sense definition "*a system is a set of interacting units or elements that form an integrated whole intended to perform some function*" and Ackoff's "*a system is a set of two or more elements that satisfies following conditions: the behavior of each element has an effect on the behavior of the whole, the behavior of the elements and their effects on the whole are interdependent, and however subgroups of the elements are formed, all have an effect on the behavior of the whole but none has an independent effect on it*"

It can be said that systems exist everywhere. Boulding (1956) has described the hierarchy of systems according to their complexity; 1. framework of static structure, 2. the clockworks of physics and astronomy, 3. the control mechanism or cybernetic system, 4. the cell or self-maintaining structure, 5. the genetic or plant level, 6. the animal level with purposive behavior and self-awareness, 7. the human level, and 8. social organization or individuals in roles. The idea of this classification is that phenomena that are

explained become more complex at each level. Boulding believes that adequate theoretical models have been developed only for the first four levels and their analogical use to higher level phenomena is problematic. (Katz & Kahn 1978: 8; Magalhaes 1998: 93.)

Lately dynamic or complex systems have gained a lot of attention. Different areas of science have used complex systems in their theory formation. For example, Arthur (Arthur, Durlauf & Lane 1997; Arthur 1996; Arthur 1999) speaks about economy as an evolving complex system and states that traditional economic theories search equilibrium, whereas theorists with complexity perspective broaden this view by focusing on the question of how actions, strategies or expectations might react in general, and endogenously change with the aggregate patterns these create. Further, Arthur (1996) speaks about the phenomena of positive feedback and increasing returns. Ilya Prigogine worked on the area of chemistry and physics and he was focused on chemical processes and systems, and eventually considered how his findings of self-organization could be applied to social systems (Stähle 1998: 47–48). Booker, Forrest, Mitchell and Riolo (2005: 3) state that genetic algorithm, which has played an important role for researchers of complex adaptive systems was developed by John Holland and his works on adaptation, learning and modeling of both natural and artificial systems has had a fundamental impact on numerous fields. Another pioneer on the field of artificial life is Chris Langton whose research interest is the complex system behavior and self-organization which is based on the simple rules of the individual agents (Baets 2004: 57). With the aid of artificial life we can try to understand the behavior of different systems, for example the flock of birds or bee colony. Conway's Game of Life is one of the computer applications which simulate life, and which is based on simple rules. According to Juuti and Luoma (2009) with the aid of these artificial life applications we (researchers, managers) can create our own systems (organizations, populations, etc.), give different rules (strategies, basic values, etc.) and see how they produce different systems based on the feedback loops (see De Geus 1997: 66-74 for practical example in Shell Corporation). Thus, we can evaluate different set of rules. It follows that these applications bring us whole new ways to understand the systemic nature of organizations.

Last, Stacey (2001, 2007) attacks quite heavily against the prevailing system theories, especially traditional open system theory is criticized. He claims that we should move from system thinking perspective to complex responsive process perspective, and we should abandon the assumptions of autonomous individual, position of objective observer and managers as objective designers and replace them with simultaneous social construction of individual and group identities, methodological position of reflexivity in

both individual and social terms, and thinking oneself as an “*active participant in complex processes of relating to other people in all aspects, both good and bad*” (Stacey 2007: 441). Still, even though Stacey criticizes system thinking it should be noted that complex responsive process perspective has also many characteristics common especially with the newer system theories.

2.1. The principles of an open system

Traditionally systems can be seen as closed systems or open systems interacting with their environment. Characteristic of closed systems is tendency to move towards *entropy*, randomness and disorder. Open systems interact with their environment through material, information and energy flows. They adapt to their environment and prevent entropy by changing their structure and processes of their internal *components* in order to maintain *equilibrium*, the balanced state. (Kast & Rosenzweig 1974: 109.)

Katz and Kahn (1978: 23–30) give ten common characteristics for open system:

- it imports energy from external environment
- throughput and transformation of input in system
- output of the system which is exported into environment
- systems as cycles of events
- negative entropy
- information input, negative feedback and the coding process
- the steady state and dynamic homeostasis
- differentiation
- integration and coordination
- equifinality

Energy is imported from external environment into the system, which is then transformed during the process of throughput and exported into the environment as an output. Bridges built by engineering firm or carbon oxide produced by lungs are examples of outputs. Systems are cycles of events, for example firm selling a product receives money and buys new raw materials, which in turn are transformed into output products. This cycle of input, transformation and output is cycle of negative entropy. The tendency to move towards chaos is reversed and is crucial for the life of a system. As system functions, it gets information about its own actions in relation to the environment. The

simplest information found in all systems is negative feedback. It tells a system to correct its position to the right course. As information from environment is too complex, system must select what kind of information it acquires. Coding process simplifies the information into a few meaningful categories of a system. As there is continuous inflow of energy into system, it still maintains its character, the ratio between energy exchanges and the relations between the parts as same. Differentiation refers to the act where global patterns are replaced by more specialized functions. As differentiation proceeds, integration and coordination processes in a system make it function as one entity. Finally, equifinality refers to the principle that a system can reach the same final state through different initial conditions and through different paths. (Katz & Kahn 1978: 28–30.)

Systems are separated from their environment by their *boundaries*. In a closed system boundaries prevent any interaction with its environment, whereas in open systems boundaries act as a filter between system and its environment. Especially in social systems boundaries are not easily identified. A system consists of many subsystems and it is always a part of a larger *suprasystem*. Through continuous *feedback mechanisms* open system acquires information from its environment which helps it to adjust. Whereas closed systems move towards entropy, open systems move to the direction of higher level organization and differentiation. Causality does not hold in open systems, the final results can be achieved through different initial conditions and in different ways (Kast & Rosenzweig 1974: 114–119).

Organizations can be divided into smaller interconnected subsystems. Katz and Kahn (1978: 52–55) have recognized a production or technical subsystem, concerned with the work done on the throughput; a supportive subsystem, providing inputs or disposing outputs; a maintenance subsystem, taking care equipment, including human beings; an adaptive subsystem, sensing environmental changes and a managerial subsystem which controls, coordinates and directs other subsystems. From those, managerial subsystem can be divided into its own subsystems, operative, coordinative and strategic, according to Kast and Rosenzweig (1974: 121–122). *Operating subsystem's* primary concern is economic-technical rationality, and it tries to create certainty by closing the central core to many variables. Its primary task is to accomplish objectives effectively and efficiently and its focus is on short run, and its point of view is optimizing. Its general processes are programmable and its decision making techniques are based on quantitative, computational numbers. *Strategic subsystem's* primary task is to relate organization to environment and to design comprehensive systems and plans. It is open towards environ-

ment and its viewpoint is to find workable solutions to complex problems. Its general processes are non-programmable and its decision making techniques rely on judgmental and cognitive reasoning. *Coordinative subsystem* is situated between these two and its primary function is to integrate internal activities. It is involved in interpreting results from operating subsystem and focusing existing resources in appropriate directions. The smaller the firm, more likely one individual has to perform in many roles.

2.2. The principles of connectionism

Connectionism is a way to see information processing, which has been inspired by the understanding of our brain, and it is also known as neural network -model. Cilliers (1999: 26) describes the function of neural network accordingly:

“Functionally the nervous system consists only of neurons. These cells are richly interconnected by means of synapses. The synapses convey the stimulation generated in a previous neuron to the dendrites of the next neuron in line. If this stimulation exceeds a certain threshold, the neuron is triggered and an impulse is sent down the axon of neuron. This impulse in turn provides the synaptic input to a number of other neurons. The information passed from one neuron to the next is modified by the transfer characteristics of the synapses, as well as by the physical structure of the dendrites of the receiving neuron. Any single neuron receives inputs from, provides inputs to, many others. Complex patterns of neural excitation seem to be the basic feature of brain activity.”

In the connectionist model, also known as the neural network, biological neutrons are divided, active cells, which are capable of complex communication with each other and communication and interconnections of neutrons happen in “synapses”. History of neural networks can be drawn from 1960s, to the studies of *cybernetics* and from 1970s to the studies of *perceptrons*. These neural networks process information as typical for living systems in dynamic and self-organizing way. Self-organization is referred to the ability to simultaneously learn while processing. As required amount of connections between a set of neutrons is acquired, spontaneous self-organization phenomena emerge. Further, these networks can learn to (1) recognize common pattern from large number of examples, (2) associate one pattern with another and (3) distinguish one pattern of input from others. (Aeh 1989: 23.)

Neural networks are one possible model to describe the function of complex adaptive systems. There is no unified theory for complex adaptive systems, but four interesting elements can be recognized. First (1) are agents with schemata. In organization they can be individuals, groups or coalitions of groups. The behavior of each agent is dictated by *a schema*, a cognitive structure that determines the actions of the agent based on its perceptions of its environment. These schemas can be different or same amongst the agents. Second (2) element is self-organizing network sustained by imported energy. Agents are partially connected to each other by feedback loops, and each agent observes local information only, which is derived from other agents it is connected to, and acts accordingly. Imported energy is a necessity for self-organization. Third (3) element is co-evolution to the edge of chaos. Agents are unable to foresee system level consequences for their choices, so they adjust their actions to “optimize their fitness” locally. As other agents also make their own choices, the environment where to mirror own action changes continually. Thus, they co-evolve with one another. Fourth (4) element is recombination and system evolution. This happens through entry, exit and evolvment of agents. The local changes affect global characteristics of system, and for example actions do not just happen through feedback loops, they also change these loops. (Anderson 1999.)

The learning in connectionist model can be modeled through Hebb’s rule, named after its inventor Donald Hebb in 1949. He stated that the relationship between two neurons increases depending on how often it is used. If two neurons are active simultaneously, it increases the strength of their interconnection. This makes network to develop an internal structure, based only on the local information each neuron receives, which can be called learning. (Cilliers 1999: 17.)

Cilliers (1999: viii–ix) makes a distinction between complicated systems and complex systems. If it is possible to give a full description of the parts of which a system consists, it is considered complicated system. Computers and jumbo jets are given as an example. If the systems parts are interconnected with each other and with the environment and it cannot be analyzed by focusing only on its parts, system is considered complex. The brain, natural language and social systems are given as examples. Dynamics of self-organization can be seen as general property of complex systems (Cilliers 1999: 90).

Social self-organization happens in social system where the active human beings are components. Human actions are the basis of the social systems, and by the interaction of human actors new social qualities and structures can emerge, which are irreducible to individual level. This process of bottom-up emergence is called agency. In practice it means that at least one *systemic quality that cannot be divided to its elements*. Social structures also influence individual acting and thinking. They enable and constrain actions. This process is top-down emergence, where new group and individual properties can emerge. This circular process is a systemic societal self-organization. “*Societal structures enable and constrain actions as well as individuality and are result of social actions (which are emergent result of connected individualities)*”. (Fuchs & Hofkirchner 2005: 245.)

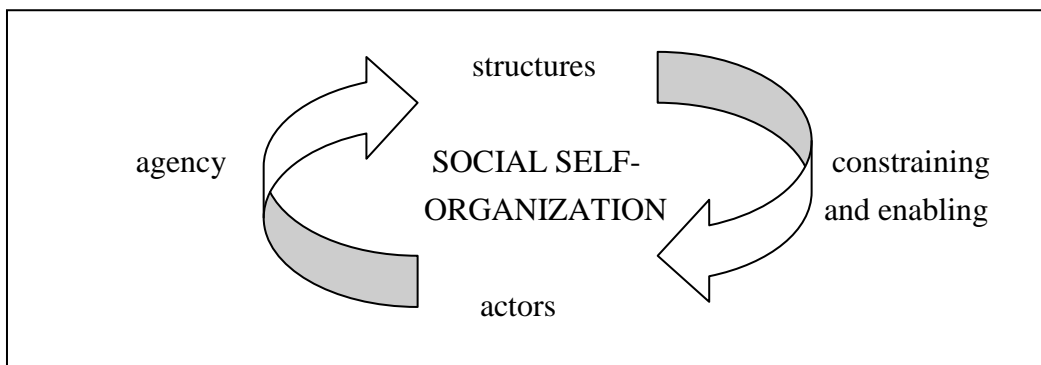


Figure 1. Self-organization in social systems (Fuchs & Hofkirchner 2005: 245).

Nobel prize winner, physical chemist Ilya Prigogine offers another view to self-organization. Ståhle (1998) has studied the system’s capacity to self-renewal, and used the vast work of Prigogine, starting from the 60s and 70s as one of its corner stones, and has concluded five principal features of self organization. First concept is state of *far-from equilibrium*. It is this state where system is able to self-organize, create order out of chaos. In practice this means that (1) *contradictory conditions* exist inside the system, for example opposing viewpoints in social system or (2) *forceful fluctuations* are taking place inside the system, for example in social system new information can cause system to move far-from equilibrium. Second concept is *entropy*, which signifies the *kind of energy (or information) that cannot be utilized by the system*. In order to self-organize the system must be able to produce entropy in order to reach the state of chaos and to dissipate entropy to yet again self-organize. In social system this could mean obtaining information without making interpretations and tolerating confusion and finally making decisions making priorities, focusing and abandoning the un-necessities. Third concept

is *iteration*, continuous, extremely sensitive feedback process. It enables system to form an existing pattern again and again. This feedback could be termed resonance as the word describes it better, it is that sensitive, and processes include both negative and positive feedbacks, which reciprocally support and obscure growth. Further, iteration provides the spontaneity to organization. In social system, more receptive the members are and react to environment and each other, more sensitive the system becomes. Fourth concept is *bifurcation*, which includes three characteristics: there are certain times in systems life when it can make genuine choices, these decisions cannot be predicted in advance and the choices made are irreversible. Fifth concept is constructive role of time, as system creates its own history as it moves from one bifurcation point to another. (Ståhle 1998: 51–67.)

2.3. The principles of an autopoietic system

Another way to view system and alternative to connectionist and open system view is the theory of autopoiesis, created by Maturana and Varela in the early 70s, which was developed to characterize the organization of living systems (Jackson 2007: 79). Von Krogh and Roos (1995: 34) state that this approach was a reaction against the prevailing reductionist method in natural sciences and especially in molecular biology. Reductionist methods were used in dividing complex systems to always smaller parts, until it was possible to focus to one small component, for example on DNA and its elements. Autopoietic view focuses on cooperative relations of the whole cellular system instead. According to Varela et al. (1974), to be considered autopoietic following conditions must be met (Hall 2005; Jackson 2007):

1. The system must have a boundary
2. The components of a system are determined by the system.
3. The system has dynamic nature. It determines the interactions and transformation of its components
4. The system dynamically maintains its identity. System processes work to maintain the integrity of the system
5. System produces its own components. Components from internal or external environment are transformed by system processes to make them functionally and identifiably parts of the system
6. The produced components must be sufficient to produce the system.

Luisi (2002: 159) composes the requirements and refers to Varela (2000), and suggests that three criteria must be met: system has to have semipermeable boundary, which is produced within the system, which encompasses reactions that regenerate the components of system. Jackson (2007: 79) clarifies the concept of autopoiesis using the distinction made famous by Maturana and Varela. He divides systems to allopoietic and autopoietic. Allopoietic machine produces something else than itself in its process of production. A blender, computer and a light bulb are given as examples. Autopoietic system on the other hand produces itself, and self-production is its only action. It can be said that autopoietic systems are thus purposeless (Jackson 2007: 79).

Table 3. Characteristics of autopoietic system based on literature (Maula 1999: 82).

CHARACTERISTIC	DEFINITION
Organization	The relations between components and the necessary properties of the components that define the unity as a whole, and thereby its identity, type or class
Structure	The set of actual components belonging to a particular concrete example or instance
Triggers	Signals, treated only as perturbations, not as an input to the system
Structural coupling	Reciprocal interaction (mutual relationship or correspondence) with the environment. History of recurrent interactions leading to the structural congruence.
Interactive openness	The system interacts with the environment and compensates the perturbations by improving knowledge (distinctions) and changing its structure
Organizational closure	Any change in the system is a structural change. The product of the transformation is the very organization itself.
Self-referentiality	<ol style="list-style-type: none"> 1. Accumulated knowledge affects the structure and operation of system 2. The system affects the (creation of) new knowledge
Autopoiesis	A system produces its own components and renews itself in a way that allows the continuous maintenance of the integrity of the structure.
Identity	<ul style="list-style-type: none"> • Being composed of components and their relationships. • Being distinguishable from other unities
Social coupling	Reciprocal interaction (communication) using language

All autopoietic systems have an organization and structure (Stacey 2001: 237). Organization (identity) describes the system; it is an abstract concept of the nature of components and their relations between them that are required in order to system fit in certain category or type. It can be seen as the dynamics of interaction within the system, the context within which the components interact. Structure is the concrete operations of system, the arrangement of systems components in order to maintain its identity. Von Krogh and Roos (1995: 35) present the difference between organization and structure by using the words of Varela (1984: 25), who defines organization and structure as follows: “...its organization which are the necessary relations which define the system and its structure, which are the actual relations between the components which integrate the system as such. Thus ex-definitione, the organization is invariant while a system maintains its identity without disintegration; structures can vary provided they satisfy the organizational constraints.”

Further, Stacey (2001: 237) states that autopoietic systems are organizationally (operationally) closed. Thus, system can import material, energy and information and export waste, but its organization (identity of system) cannot be changed from outside. Only operations inside system can change its organization. This does not mean that system is closed, it communicates with its environment and other systems, but they can only trigger internal changes in system. It follows that as the environment can never determine, direct or control changes in a system, autopoietic system knows its environment in knowing itself (Von Krogh & Roos 1995: 38). It can be said that autopoietic systems are self-referential because they cannot enter into interactions that are not specified in the pattern of relations that define their organization, so its environment is really a reflection and part of its own organization (Morgan 1997: 254). Thus, autopoietic systems are autonomous, which in this case means that they maintain their identity. System produces its own components, and the rules of functioning are coded in its organization and the way it reproduces itself (Von Krogh & Roos 1995: 37). Mingers (1995: 10) explains it (in Stacey 2001: 237): “Maturana and Varela pick out the single, biological individual (for example a single-celled creature such as amoeba) as the central example of a living system. One essential feature of such living entities is their individual autonomy. Although they are part of organisms, populations, and species and are affected by their environment, individuals are bounded, self-defined entities.”

Structural coupling is one of the characteristics of autopoietic system. The basic autopoietic entity is a cell. When many autopoietic entities become structurally coupled, they can create multicellular entities. Further, these second order autopoietic entities

usually develop a nervous system and it becomes possible for them to interact with other beings, more deeply than mere perturbations. These interactions are often termed social phenomena, and the emergence of social systems which exhibit social phenomena become third order entities. (Parboteeah & Jackson 2007: 251.)

In other words (Stacey 2001: 237), autopoietic systems are structural coupled with their environment and other systems. System is not dependent on environmental changes, but rather its own operations/identity/operational processes define the structural shape it takes. However, in case autopoietic entity loses its identity, it dies.

Self-referentiality is also one of the characteristics of an autopoietic entity (Maula 1999: 80). It means that (1) accumulated knowledge affects the system's structure and operation and (2) system affects the creation and acquisition of new data. Knowledge that is formed from that data is dependent from system's interpretation structure. As a consequence, system's environment becomes internalized. Ståhle (1998: 79) also explains self-referentiality and refers to Varela which states that the one who designates the borders of system actually belongs to system and specifies the boarders of the system according to own needs and viewpoints. Moreover, she concludes that the logic of self-referentiality can be stated as "*what we see is always a reflection what we are*".

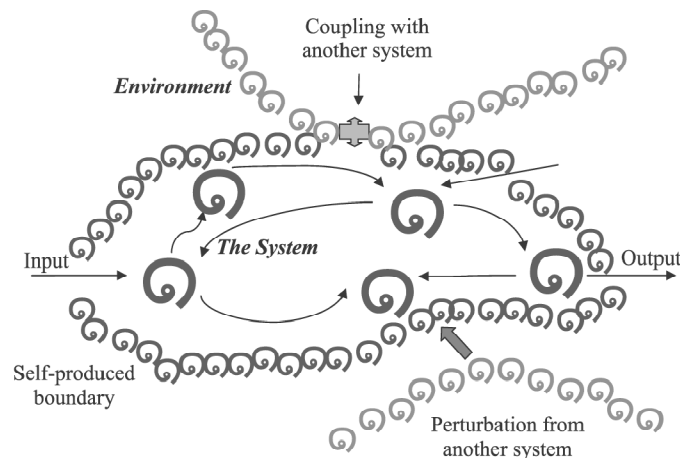


Figure 2. Key features of autopoietic system (Gregory 2006: 964).

As autopoietic system is not accessible to anything except the system itself, it is only open to observation. Thus, all characteristics can be only given from the viewpoint of an observer. There are two ways to observe autopoietic system: focusing on its internal

structure or focusing on its environment. In former case environment is seen only as a background and system properties emerge from the interaction of its components. In latter case system is seen as simple entity with certain interaction with its environment. This causes the problem of controlling the system's behavior. As it is, the observation itself is an operation of an autopoietic system. (Von Krogh & Roos 1995: 40.)

"...it is we who observe the event. The leaf, the wind, the frog, and the shadows are all part of our experience, and the events we describe, as well the differences between them, are the results of the relations we have established between parts of our experience ... we cannot step outside [our cognitive domain] and see ourselves as a unit in an environment ... what the observer now takes to be his own environment is still part of his experience and by no means lies beyond the interface that is supposed to separate the knower from the world he gets to know" (Varela 1979: 273–274 cited as in Von Krogh & Roos 1995: 34).

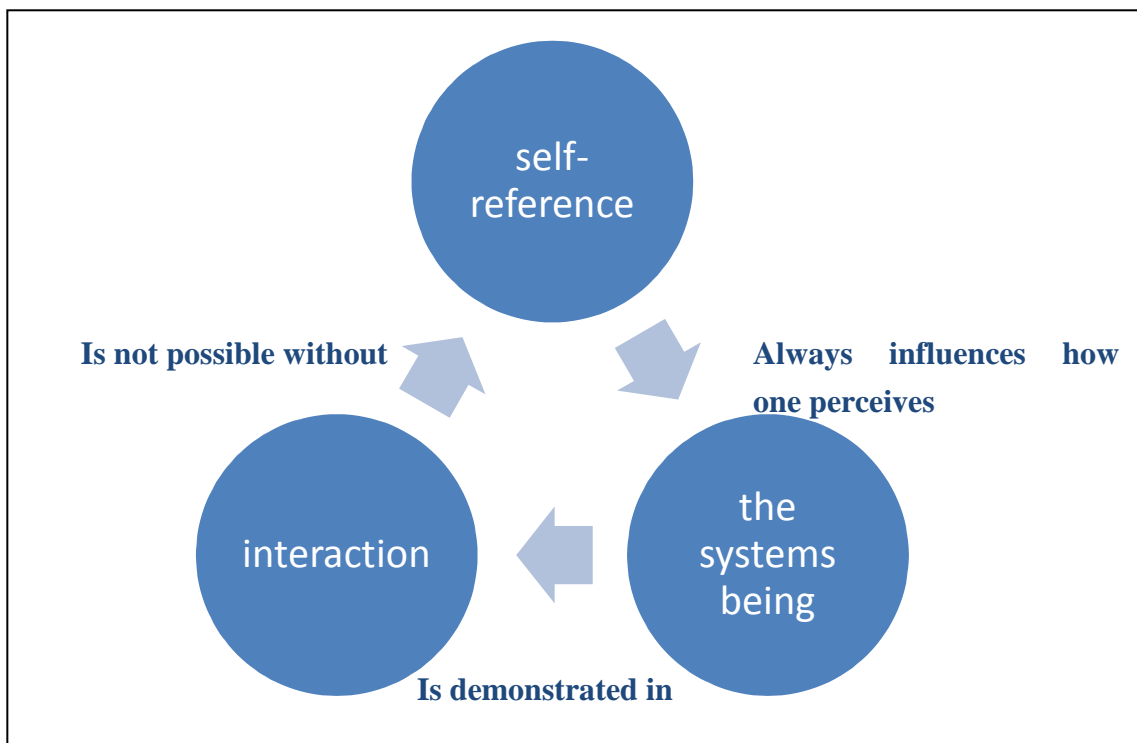


Figure 3. A systems autopoietic nature (Ståhle 1998: 81).

According to Mingers (1990), the philosophical foundations of autopoietic theory can be found from the area of critical realism, which accepts the *structural-determined* na-

ture of individual's nervous system and thus accepts the limits on the access of external reality that an individual has (Kay 2001: 469). Maula (1999: 105–118) has studied further the philosophical basis of autopoiesis theory, and found that the philosophical positioning is not necessarily easy. Maula (1999: 105–118) concluded that options are that autopoiesis theory can be interpreted within the critical realist paradigm, it can be associated with phenomenological constructionism, its positioning is left open until the theories develop, it is regarded as independent and separate philosophical paradigm or it is seen as neutral meta-philosophy, which can be used to view old paradigms in a new way.

Autopoietic systems approach is in summary, focused on autonomy realized through the process of self-production, production of feasible responses to perturbations, structural coupling between systems and how systems persist and maintain identity despite changes in components and structure. (Gregory 2006: 964.)

2.4. Competence system of organization

In this chapter different views to understand competence are studied. Moreover, previously presented system-theoretical frameworks are reflected to contemporary theories of competence. Further, some theoretical implications found in the literature of management and organizations are provided. Sanchez's model (2004) is chosen for a first examined frame, as it tries to understand competence in organization at different levels. This model for organizational competence defines competence in *dynamic, systemic, cognitive and holistic terms*. Further, its open system view incorporates interactions between organization's assets (capabilities and skills included), management processes and its strategic logic for using assets in order to reach its goals (Sanchez 2004: 519). Other framework is offered by Dyer and Ericksen (2005), whose framework is based on self-organization. Last, some alternative frameworks are provided which are based on autopoietic notion of systems.

2.4.1. Competence in different levels

The term competence is used widely in business literature. However, there are many overlapping ways to view the concept. At least following approaches and concepts related to competence and its management have been found in literature: learning organization, intellectual capital movement, knowledge management, individual or employee

competence, core competence, capabilities based competition, competence-based strategic management, dynamic capabilities and absorptive capacity (Hong & Ståhle 2005; Laakso-Manninen & Viitala 2007). As competence management literature encompasses a vast scale of literature, many authors have developed the field of competence management from different angles. Especially the end of 20th century was productive time for this movement. Among the terms “knowledge society” and “organizational learning”, resource-based approach gained attention. This view sees organizations’ resources and capabilities as the basis for competitive advantage. The roots of this view derived from Penrose’s (1966) theory of the firm. Main proponent’s for this movement were Prahalad and Hamel (1990) as they presented their core competence theory, Stalk, Evans & Schulman (1992) with their capabilities based competition and Teece, Pisano and Shuen (1997) with their dynamic capabilities theory. The common factor for all these concepts and approaches was to focus on the competence of organization. Since then, many approaches have molded the field from different points of view. Only emphasis differs. Some approaches take individual as a starting point, where as other side starts from organization level. The problem with many approaches to competence is that as they focus deeply on certain dimension, they neglect the other dimensions, which causes troubles in the real world setting.

Crossan and Bedrow (2003: 1088–1089) state that research on organizational learning has been largely disconnected from strategy, because of too narrow conceptualization, failure to address the fundamental tension between exploration and exploitation, and lack of practical testing. The need of more holistic model is noted, and for example Spanos and Prastacos (2004) provide an integrating framework for organizational capabilities, where human actors, their skills and knowledge are constituents of competence, and capabilities are seen socially constructed entities that weave organization’s assets, particularly human capital, together. Bontis, Crossan and Hulland (2002) suggest that firms might be over investing in the development of individual competencies and capabilities and under investing in mechanisms that facilitate the flow of learning between individual, group and organizational levels. They continue by claiming that the dynamic interplay between these levels and processes has positive relationship to business performance.

Moreover, competence discussion should be examined from different levels. At the individual level concept of competence has some different interpretations. Håland and Tjora (2006), following Garavan and McGuire (2001), Hoyrup and Petersen (2003) and Sandberg (2000), have gathered two principal perspectives on competence in the com-

petence management literature. The two principal perspectives they found were *the rationalistic and positivistic perspective* and *the phenomenological-, humanistic-, and social constructivist perspective*. Håland and Troja (2006) refer to Hoyrup and Pedersen (2003), who have identified two different views of competence. The first one is the rationalist, positivistic paradigm, where competence development means maximizing workers' total work abilities. The purpose is to increase profit by developing individual workers' competencies through learning. In this view, competence is seen as a context-free, individual characteristic. The second one is humanistic, phenomenological and social constructivist paradigm, where competence is seen as relations and work life is meant to support workers' independence and experience of work life as meaningful. Further, according to Garavan and McGuire (2001: 146–147) there are philosophical and epistemological tensions behind the different perspectives on competence. The majority of competency literature provides a rationalistic and positivistic perspective, in which competence is seen as attributes-based, context-independent, atomistic, mechanistic and bureaucratic. Phenomenological approach is presented as an alternative. It suggests that the internal organizational context and the role of the employee and his experience at work should be emphasized. Finally, Sandberg (2000) divides discussion on competence into rationalistic approach, where human competence at work is based on a set of attributes, and into interpretative approach, where competence is understood as constituted workers' experience of work.

On the organizational level, definitions and angles to study competence also differ. Cohen and Levinthal (1990) studied organizations' capability to recognize, assimilate and use external information, which they labeled absorptive capability. Nordhaug and Gronhaug (1994) examined how individual competences and collective competences act as an organizational resource. Leonard-Barton (1992, 1995) used the term core capabilities and core rigidities. She pointed out that core capabilities can turn into core rigidities. Long and Vickers-Koch (1995) presented their view, where two kinds of capabilities were presented, starting from *threshold capabilities*, necessary to "be in the game", like services for internal customer and skills and systems needed doing business in organization's industry and *core capabilities* which were further divided into critical core capabilities, which create competitive advantage at the moment, and to cutting edge core capabilities, which provide competitive advantage in the future. Drejer (2000) composes competence from four elements: (*hard*) *technology*, tools that the human beings use to do activities, including machinery, software systems, databases, tools and so on, *human beings*, essential part of competence, *organization*, formal managerial system under which human beings functions including planning and control systems, reward systems,

information channels, hierarchy of responsibilities and other formal organization manifestations which affect human behavior, and finally *culture*, the informal organization of the firm, including shared values and norms, which guide human actions.

According to Viitala (2005: 175) the infrastructure for competence management consists of the following things:

- planning and follow-up system (quality and quantity of competence)
- competence development system (familiarization, development discussions, competence mappings, human resources development and work community development)
- supporting HR functions for competence (recruiting, hiring, career planning, well-being, employment)
- knowledge management and knowledge systems
- organizational structure and task organization
- operations models and practices supporting learning
- management of competence risks

These elements build a competence management system. Moreover, sustaining the competence level the organization needs, and developing it even further requires architecture which supports competence development and usability. It is common that only some of these elements are included in organization's competence management system. However, in the ensemble these elements support each other and develop according to organizations strategic goals. (Viitala 2005: 175.)

Drejer (2000) continues by proposing distinction between the competences based on their complexity level. First competence type is a situation with a single technology and a few people, and the competence is rather easy to identify. The second type consists of interwoven technologies in a larger organizational unit. This may require different capabilities to work efficiently, and organizational structure and processes are necessary for the coordinated use and interplay of the various technologies. The third type consists of complex systems connecting many persons in different departments and organizational units. *This kind of competence is at the heart of the competitive strength of a company – it is complex, more difficult to imitate and less dependent on technology/more dependent on knowledge.* Naturally, it is difficult to identify this kind of knowledge. This complex type of competence builds on organizations quality management system, production management, system tacit knowledge of individual employees inte-

racting collectively and attitude and organizational culture of the company, to name a few. None of these three types of competences should be viewed as static entities, but as always developing.

2.4.2. Open system view to competence management

Sanchez (1997, 2001, 2004; Sanchez & Heene 1996, 2004) offers a holistic approach, where competence can be seen as *“the ability to sustain coordinated deployment of assets in ways that help a firm achieve its goals”* (Sanchez 2004: 521). Five modes of competences can be identified, which lead to organizational flexibility, and which provide different strategic options. These competence modes are cognitive flexibility to define alternative strategic logics, cognitive flexibility to define alternative management processes, coordination flexibility to identify, configure and deploy resources, resource flexibility to be used in alternative operations, and operating flexibility in applying skills and capabilities in uses of available resources (Sanchez 2004).

According to Sanchez (2004), the first competence mode describes organizations' cognitive flexibility to think alternative solutions to create value in markets. The main source of this mode of competence is the collective corporate imagination, organization's managers' ability to see different ways to create value to markets. Usually competence mode one resides with the strategic managers, who have power to act as visionary leaders or power to withhold the breakthrough of new ideas. Bove, Harmsen and Gruert (2000: 37) found out that it is important to look holistically at those strategic competences, instead of focusing on single competence that is thought to be basis for a success without reference to other competences, as they are intertwined and form a complex web within they support and suppress each others. Second competence mode results also from cognitive flexibility of managers to bring forth alternative management processes in order to implement strategic logics identified by competence mode number one. This competence mode consists of managers' abilities to identify required resources (assets, knowledge, capabilities) to carry out current strategic logic, to create effective organizational designs (allocation of tasks, decision making, information flows) for processes using required resources and to define controls and incentives for monitoring and motivating value creating processes that follow current strategic logic.

Third competence mode builds on coordination flexibility to identify, configure and deployment of resources. Managers have to define the ways that created value is distributed across the organization and attract best providers of those resources, which can be

found inside or outside the firm. Configuring of processes means defining activities that are most effective, when used just identified resources, and designing a way those activities interact with processes. To deploy a resource chain, managers must be able to focus on activities of a resource chain that are in line with direction determined by competence modes one and two. Fourth competence mode describes organizations flexibility to use existing resources in alternative ways. The flexibility of a resource can be described by its usability in different ways, the time it takes to change a resource and costs that incur when resource is changed. This competence mode is based on flexibilities of resources organization can access or acquire when building resource chains and those flexibilities thus create organization's portfolio of strategic options. Fifth competence mode builds on organization's operating flexibility in applying skills and capabilities to available resources. The different process design decisions result from decisions in competence mode three and four. However, organization's flexibility to operate effectively within a chosen process design derives from competence mode five. (Sanchez 2004.)

Sanchez's (2004) thinking is based on the view of organization as an open system. Organization viewed as an open system consists of different system elements, which interrelate with each other constantly. *Product offers* for certain product markets are the outputs of the system, *operations* connect organizations' resources to its processes, *tangible assets* are physical assets of the firm, *intangible assets* consist of knowledge, intellectual property, relationships and reputation, *management processes* coordinate organizational resources and *strategic logic* defines how organization creates value in markets and it provides strategic goals for organization. (Sanchez 2004.)

Sanchez and Heene (2004: 46–47) define a system accordingly:

“a system is said to exist when a collection of entities (people, things, ideas) interact in ways that create interdependencies between the entities. The competence perspective characterizes an organization as a system of resources (human, tangible, intangible) that interact and become interdependent in variety of ways, the most important of which are determined by the organization's management processes.”

Organizations are embedded and they co-evolve with their environment on several levels. An organization as an open system is embedded most directly in its product and resource markets, but it is also embedded in strategic groups within its industry, in its

industry more broadly, in its national and regional economies, in the global economy and its society. (Sanchez & Heene 2004: 49.)

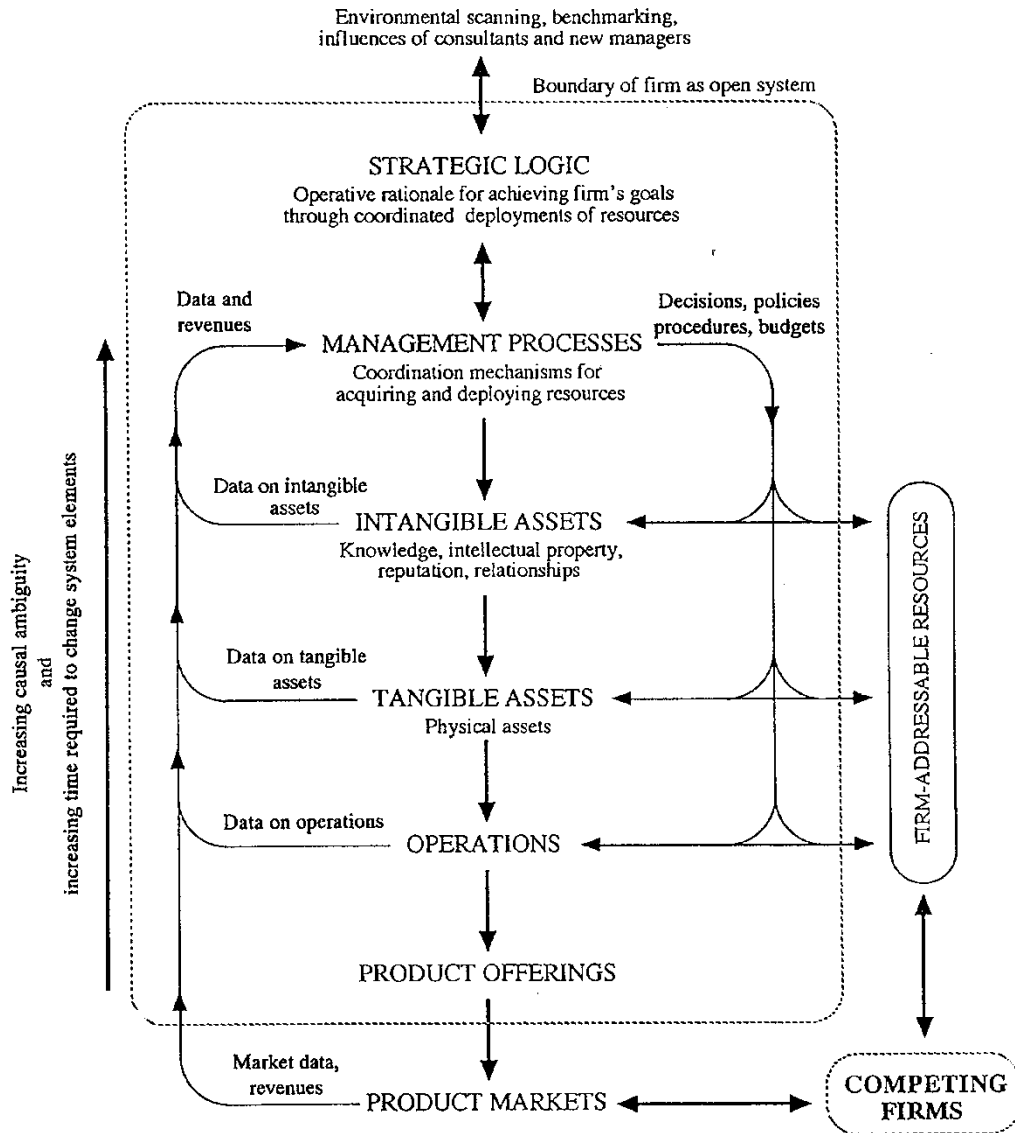


Figure 4. Firm as an open system (Sanchez & Heene 1996: 17).

As organization is guided by its strategic logic, which guides every action individuals and groups take in organization, it gives a framework for organizations' management processes how to coordinate assets (Sanchez 2004). Management processes include three aspects: they gather data from organizations product and resource markets, larger economic and industry environment and from other system elements, they interpret data

between external environment and internal system elements, and they are processes for making decisions, setting policies and defining standard procedures for coordinating resources and allocating budgets (Sanchez & Heene 2004: 52). Thus, this strategic logic is constantly tested through external and internal feedback (Freiling 2004: 43). These feedbacks affect strategic managers' perceptions of current and desired state of organizations elements in organization's value creation process (Sanchez & Heene 1996: 16-17, 2004: 53). Managers receive information through *lower-order* control loops, which include data from lower level system elements, product markets, operations and tangible assets, and through *higher-order* system elements, which include data from intangible assets, management processes and organizations strategic logic (Sanchez & Heene 2004: 54). Strategic managers' perceptions of strategic gaps depends on which control loops they rely on. The data from lower level system elements is useful in maintaining competence leveraging activities, but not good indicators of a need for competence building processes for improving higher-order system elements (Sanchez & Heene 2004: 52).

2.4.3. View of competence based on the self-organization

Dyer and Ericksen (2005) emphasize the role of changing environment and state that human resource scalability is at least a hygiene factor for organizations acting in stable environments but it could be a source for competitive advantage for the many companies acting in more turbulent environments. They turn to complexity sciences and especially to the notion of self-organizing systems. They state that these systems can be found in organizations especially in an environment characterized by crisis: for example in the emergency room at hospital or in the case when army unit is cut off from the chains of command.

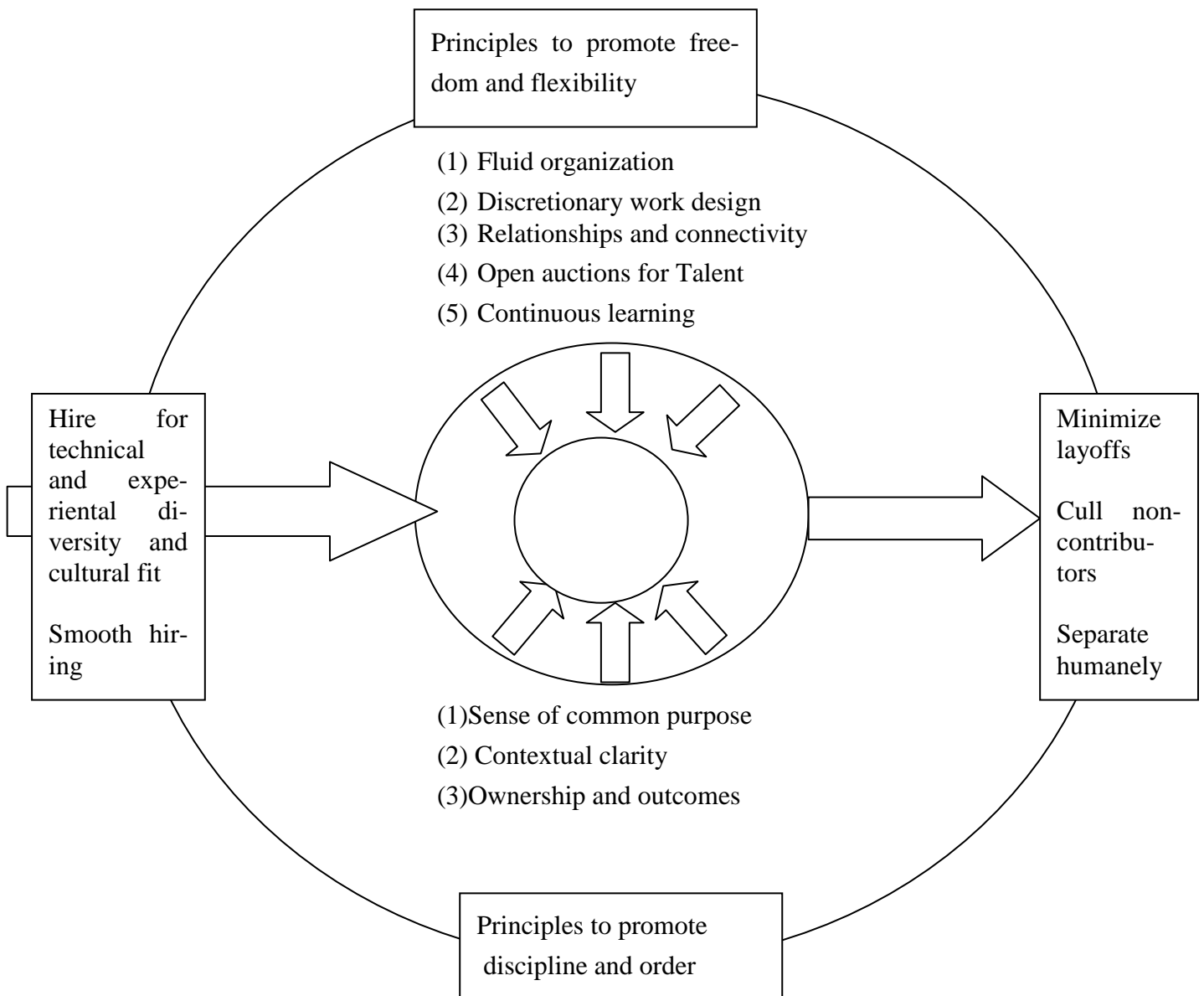


Figure 5. Context for human resource scalability based on self-organization (Dyer & Ericksen 2005).

According to Dyer and Ericksen (2005) system designer's and participants' task is to provide guiding principles which on the other hand support freedom and flexibility and on the other hand promote discipline and order. The guiding principles for flexibility and freedom are: (1) static organizational charts should be avoided and leadership should be waited for to emerge where needed, (2) employees should be expected to decide what needs to be done and also made sure it gets done, (3) social interaction should

be encouraged, for example designing physical environments accordingly, (4) open discussions about career opportunities should be encouraged and (5) relentless drive for development should be fostered. The guiding principles for promoting discipline and order are: (1) vision and core values should be deeply embedded in organization, and rewards and performance should be reflected in part against these goals, (2) people should understand how and why human resource scalability matters and (3) hold persons accountable for outcomes. Further, these guiding principles should affect inflow and outflow of talent in a way that facilitates and only minimally disrupts the internal fluidity. (Dyer & Ericksen 2005.)

2.4.4. View of competence based on autopoiesis

Another view in organizations has been presented lately. This view approaches the question of competence and organizations holistically; it questions the rationalistic definitions of organization's boundaries and does not make clear distinction between organization and its environment. For example Hall (2005) takes this different angle to an organization and view's organization as an autopoietic entity. According to this functionalist interpretation, many organizations fit criteria for autopoiesis. He responds to the requirements of autopoietic entity accordingly:

1. First is that organizations must be distinguished from its environment. Within the collective or industry organizations actions, logos, corporate names and such differentiate organizations from environment. Individuals in organizations are "tagged" in many ways to members of organizations, such as employment agreements and uniforms.
2. Second is the requirement of organization to determine its own components. Human members become members through induction processes; legal documents define the ownership of intangible assets, etc.
3. Third is organizations complexity. The organization is constituted on physical, human and economic components, which usually are complex by themselves.
4. Organization maintains its identity. Routines, processes and procedures, such as corporate account systems, personnel systems, etc. act to maintain the identity.
5. Organization produces its own components. Organizations processes such as personnel recruitment, induction and training are production activities as they transform components as part of a system.
6. Organizations own components are enough to produce the organizations. The processes of self-production are embodied in the organizational structure itself

and encoded in the organizational memory in the form of written processes and procedures.

He adds his own final characteristics, arguing that self-produced systems are self-sustaining over time, they survive longer than their individual members.

Other applications for autopoietic theories are for example Maula's (1999, 2000) interpretation, where organization is seen as an entity with two major functions: memory and sensory function. In this model, the focus is on the character of autopoietic entities to be open and closed system simultaneously. Memory function refers to organizations self-referentiality. It is argued that the accumulated knowledge affects the firm's way to operate and accordingly the way to operate affects the creation and acquisition of new knowledge. This memory function offers access to organizations knowledge repertoire, its internal structure such as shared culture, strategies, rules and practices, its competence and expertise of its individuals or its knowledge database.

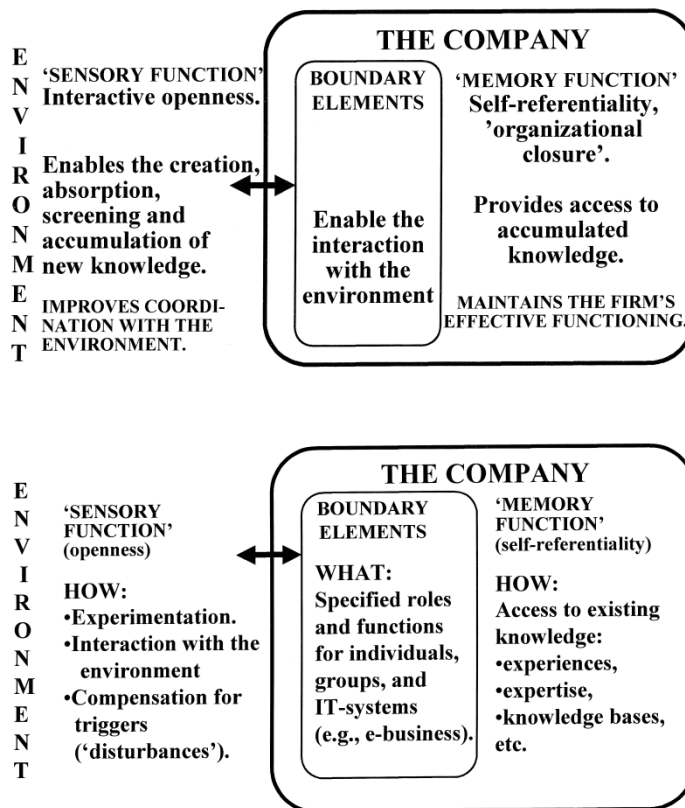


Figure 6. Sensory function, memory function and boundary elements and their contents (Maula 2000).

Sensory function in organization enables interaction with its environment. Organizations can accumulate and create new knowledge principally in three ways. By accelerating their learning and renewal processes by experimenting, interacting with their environment or by increasing the exposure to relevant triggers from environment. It is argued that through the understanding of these two major knowledge flows and integrating and aligning them with organizational variables helps building sustainable knowledge management solutions which enable continuous learning, knowledge creation and renewal. (Maula 1999; Maula 2000.)

Magalhaes (1998: 114) says that way to see systems as untouchable (organization) and part of system which can be changed (structure) by managerial action (language) is a powerful resource for a resource-based approach.

Lately the autopoietic framework has been connected to organizational learning. Jackson (2007) compared autopoietic system to learning organization and presented following list:

1. Entity must have boundary. The learning organization has a boundary, which separates it from another learning organizations and its environment.
2. Entity must have distinct components. Individuals and different knowledge bases such as documentation, training systems and databases form the components
3. System is made up of inter-reactions of its parts. Components of organization create the organizational learning system (its rules and culture) through their reactions, interactions and transformations.
4. Boundary components are a result of interactions of other components. The boundary of the learning organization is a result of the organizational routines that are unique to its system of processes of production.
5. Boundary components must be produced from inside the system. The components that make up the boundary (rules and regulations) are produced by the organizational learning system
6. All other components must be produced from inside the system. The components that make up the system (knowledge bases, culture) are produced within the system.

Jackson (2007) continues by saying that even if it looks like learning organization is a perfect example of an autopoietic system, one should still take a careful approach to it, as it is possible that the theory of autopoiesis is overly simplified if taken strictly analogously. He stresses the issues of individuals as components, purposelessness of system, the role of the external knowledge and the boundary of system should be discussed. Still, he continues that in metaphorical level for example autopoietic self-production provides an insight on how feedback-loops make organizational learning work.

One example could be the model presented by Crossan, Lane and White (1999), who have developed a framework for organizational learning. In their framework learning and organizational renewal happens in four processes through three levels. New ideas are explored by individuals through intuiting process, which are then fed forward to group and organizational levels through interpreting and integrating processes. At the same time, institutionalizing process feeds back from organizational level to group and individual level exploiting what has been learned and creating routines. Intuiting process happens through experiences, images and metaphors and it is largely subconscious process. It can be divided to expert view, which can be described as pattern recognizing, and to entrepreneurial view, which is more about making connections and discerning possibilities. Interpreting process enables individual to create cognitive maps and to name feelings, sensations and hunches. The domain and environment affect the formation of cognitive maps, but cognitive maps also define how environment is interpreted. Through the explicit language interpreting process becomes social action and shared meanings and understandings are created. Thus this process of interpreting turns into process of integrating. Institutionalizing process is more than sum of individuals or group learning. *“Some of this learning is embedded in the systems, structures, strategy, routines, prescribed practices of the organization, and investments in information systems and infrastructure”*. These four processes link individual, group and organizational levels together. (Crossan, Lane & White 1999.)

Moreover, Parboteeah and Jackson (2007) provide another framework for organizational learning as they view it through the lens of autopoiesis. In their interpretation they build their work on a model proposed by Kim (1993), whose model connected the previous organizational and individual learning theories together. They conclude that people in organizations can be considered as first order autopoietic entities and organizations as second order autopoietic entities. They continue that organizations can be considered as first order autopoietic entities, but it is not desired as the modeling of relationships between people and sub organizational processes is difficult. Moreover, they

claim that autopoietic learning resembles single-loop learning and allopoietic learning double-loop learning, both individual and organizational level, as it determines the creation of new mental models and in autopoietic entity change cannot be determined, only triggered by the external factor.

3. KNOWLEDGE IN ORGANIZATIONS

Knowledge plays a crucial role in building, sustaining and developing competencies in organizations. Thus, one eyed approach to knowledge as easily transferred commodity can cause serious setbacks at organization's everyday life. System approach provides a wider conceptual framework and allows us to examine knowledge from different sides, and it thus may reveal the possible failures of our current thinking. Understanding the complex factors related to knowledge does not necessary remove all the challenges, but it gives us at least tools to handle those. In this chapter different approaches to knowledge and its management found from literature are presented, and different ways to see knowledge and its role in organizations are studied. Moreover, cognitivist, connectionist, and autopoietic epistemologies to knowledge are examined more closely and their role in organizational life discussed further.

3.1. Different classifications of knowledge

Traditionally knowledge is divided into tacit and explicit knowledge. Nonaka & Takeuchi (1995: 9) state that the realized importance of tacit knowledge gives rise to a completely new view of organizations, not as a machine processing information but organization as living organism. In this context the understanding of what company stands for, where it is going, what kind of world it wants to live in and how to make that world reality becomes much more crucial than processing objective information. Other divisions are also made, for example Engeström (2007) suggests that knowledge used and generated in work activity can be divided into two types, based on the uses of knowledge. *Stability knowledge* is created to simplify complex reality. It is used when we try to understand difficult concepts and objects, human beings and things. Molding the reality in easier form around different categories leads to creation of "stigmatic stamps" on stabilized objects. Another form of knowledge, *possibility knowledge* emerges when one is able to depict meanings in movement and transaction, which destabilizes knowledge and thus opens up new possibilities.

It is presented (Blackler 1995) that knowledge in organizations can be seen accordingly: *embrained knowledge* is knowledge that is dependent on conceptual skills and cognitive abilities. *Embodied knowledge* is action oriented and likely to be only partly explicit. This kind of knowledge is often context-specific and based on the awareness of people. *Encultured knowledge* refers to the process of achieving shared understandings. These

understandings create cultural meaning systems, which are heavily dependent on the language used and thus socially constructed. *Embedded knowledge* is knowledge which resides in systemic routines and it can be found in relationships between technologies, roles and procedures for example. It should be analyzed from a holistic view. *Encoded knowledge* is information conveyed by signs and symbols. It can be found in books and manuals or in the electronic form. Alavi and Leidner (2001) state also that knowledge can be situated in different forms in organization. It can be tacit, rooted in actions, experience and involvement in specific context, in mental models (cognitive tacit) or know-how applicable to specific work (technical tacit). It can also be explicit, articulated and generalized knowledge. There can be a social dimension, when knowledge is created by and inherent in collective actions of a group or it can be individual, created by and inherent in the individual. Knowledge can be divided to declarative (know-about), procedural (know-how), causal (know-why), conditional (know-when), relational (know-with) and pragmatic, useful knowledge for an organization. Quinn, Anderson and Finkelstein (1996) continue in a same line and argue that knowledge exist in four levels. Cognitive knowledge is basic knowledge that employee has through training and education. Advanced skills are knowledge to apply “book learning” into action. Understanding systems is greater understanding of complex cause-and-effect relationships. The last level is self-motivated creativity, which encompasses employees will, motivation and adaptability for success. The last one resides inside the individual while the three former levels can exist in organization’s systems, databases or operating technologies.

Sanchez (2004, 1997: 174–179) claims that there are three levels of knowledge within the firm: state, process and purpose forms of knowledge. Thus, there are three different contents of knowledge, know-how, know-why and know-what. Know-how refers to practical understanding of processes and products. The main learning process is learning by doing. Know-why knowledge refers to theoretical understanding, and it affects on adapting existing processes and products or development of new products or processes. Its main learning process happens through theoretically directed learning by doing or through importing new theory. Know-what knowledge is manifested by identifying and defining new kinds of products and processes. Learning process happen either bottom-up, learning from changes in state or process theory, or top down learning by emulation, metaphor or imagination.

Table 4. Knowledge types and their uses (adapted from Sanchez 2004).

Focus of knowledge in organizations	Type of knowledge needed
Processes Strategic logic	Know-what
The use of resources Creation of alternative processes	Know-why
The use of skills and capabilities	Know-how

Alternative views have been presented also. Some authors (Firestone & McElroy 2005; Campos 2008; Hall 2005) base their distinction on Popper's (see for example Sahavirta 2006) notion of knowledge. In this philosophy three kinds of knowledge are distinguished. World 1 knowledge is represented in physical reality, in objects and structures. World 2 knowledge refers to internal mental world, including cognition and consciousness. World 3 knowledge refers to autonomous world of mental products, including scientific theories, social and cultural products and linguistic formulations. It is argued that it is more appropriate in the studies of organizational knowledge than conventional views of knowledge (Hall 2005: 172).

3.2. Theoretical perspectives to knowledge management

Even if the concepts differ, there is one thing in common: knowledge is seen as one of the most important factors in organizations success. In fact, knowledge-based view of the firm sees knowledge as a main source for competitive advantage (Grant 1996). As knowledge can be seen as resource, it differs from other resources, such as financial, physical, organizational, technological, intangible, or human resources drastically, as it takes many forms and shapes at given moment in time, it may be dynamic, hard to grasp theoretically and most importantly, it is the underlying basis for forming competences (Von Krogh & Roos 1995b). Thus it is no surprise that different ways to analyze knowledge in organizations is presented. Kakabadse, Kakabadse and Kouzim (2003) found five knowledge management perspectives from the knowledge management literature: philosophy-based model, cognitive model, network model, community of practice model and quantum model. The main concern of philosophy-model is how information is gathered about social and organizational reality, and it is focused on objectives, type and the source of knowledge. It is also interested in the relationships between knowledge and certainty, belief justification, causation, doubt and revocability. Cognitive

model is rooted in positivistic science and sees knowledge as value creative asset. It is based on the rationalistic definitions of knowledge. Focus of network model is on the network organization and on sharing, acquisition and transferring knowledge. Community of practice model is possibly the oldest knowledge management model. It is focused on interpersonal relationships and that knowledge resides in communities, in the network of actors. Quantum model assumes that communication and information technology will change radically when built using quantum principles. New knowledge is not enough, meaningful knowledge is required in order to cope with new levels of complexity and decision making.

Many authors have brought something in knowledge management discussion. Nonaka and Takeuchi (1995) brought commonly known knowledge creation-creation cycle and later (Nonaka & Konno 1998; Nonaka, Toyama & Konno 2000) the concept of “ba” into the discussion. Choo (1998) in his model added cultural knowledge in tacit and explicit knowledge classification. Leonard-Barton’s (1992, 1995) approach is the notion of the importance of knowledge creation and diffusion for innovations in organizations. The core capability and creativity are built upon innovations which require the building of organizational knowledge. For example, Edvinsson (2002) and Sveiby (1997) promote intellectual capital movement (utilizing organizations intangible assets), and Sveiby has also presented an autopoiesis based model on strategy formulation (Sveiby 2001). Zack (1999) speaks on behalf the importance of knowledge architecture and focuses on information technology and the importance of explicit knowledge whereas Davenport and Prusak (1998) put emphasis on knowledge generation, codification, coordination and transfer through knowledge management projects. Moreover, Von Krogh (2009) states that current discussion between individualist view of knowledge, which sees knowledge residing in individuals, and collective view of knowledge, which sees knowledge in collectives, shouldn’t compete with, but complement each other and information systems could facilitate that. Further, Gao, Li and Nakamori (2002) combined systems thinking and systems methodologies to knowledge management. Last, lately research streams on knowledge management, complexity sciences and organizational learning are getting closer to each other in order to provide holistic, system based approach (McElroy 2000). For example, in their vast systematic review of the debate of organizational learning and knowledge conversion, Nonaka and Von Krogh (2009), present suggestions for a future research needs on the area. Those research suggestions all include the aspect of social practices, for example the relationship between knowledge creation and social practices and the role of social practices in conservation of tacit knowledge, existing routines, organizational knowledge creation and innovation

3.3. Organizations as knowledge systems

Choo (1998) offers a holistic model to view knowledge in organizations, drawing especially from sense making and information processing theories, and distinguish three modes how organizations use information: sense making, knowledge creation and decision making. His view is that through interpretation, conversion and analysis of information shared interpretations, innovation and rational, goal directed behavior are created. Together these three form the knowing organization. Other authors also see organizations as knowledge systems. According to this view, collective understandings and interpretations that emerge in companies over the time play crucial role. Moreover, most important resource in organizations is knowledge that enables management *to make distinct uses of organizational resources by devising distinctive value-creating strategies, organizational knowledge – the ability to collectively make “better” judgments of significance than others- is what makes the difference* (Tsoukas & Mylonopoulos 2004: 9). Previously mentioned Nonaka’s and Konno’s (1998) model common place or space where knowledge is created is labeled as organization’s “*ba*”. Firstly, it can be originating *ba*, which refers to socialization mode of knowledge creation circle. This is a common place where experiences are shared primarily through face-to-face interaction. Secondly, it can be interacting *ba*, which is associated with externalization mode of knowledge creation. Here tacit knowledge is transformed through dialogue and collaboration to explicit knowledge. Thirdly, cyber *ba*, virtual interaction, represents the combination mode of knowledge creation. Fourthly, exercising *ba* facilitates the process of converting explicit knowledge to tacit knowledge and it is a space for continuous and active individual learning (Nonaka & Konno 1998). Gupta and Govindarajan (2000) emphasize the importance of social ecology and its necessity for successful knowledge management. Social ecology refers to that social system, within which people operate. It defines organization’s formal and informal expectations towards individuals, chooses types of people who fit in the organization, shapes the freedom of individuals to act independently and aim for goal, and it affects how people interact with each other, both inside and outside the organization. Culture, information systems, rewarding systems, processes, people and leadership define social ecology. Social ecology should be viewed as a single entity where every element affects to others.

Alavi and Leidner (2001) base their idea of organizations on the research in sociology of knowledge and they view organizations as social collectives and knowledge systems. According to them, these knowledge systems consist of four sets of socially enacted knowledge processes: creation (construction), storage/retrieval, transfer and application.

These processes are not just a set of activities functioning separately, but intertwined and interconnected set of activities, happening simultaneously, embedded in physical structures, groups and individuals (Alavi & Leidner 2001: 123) Gupta and Govindarajan (2000) see that as the life time of knowledge is getting even shorter, an effective knowledge management machine must excel at two central tasks, which are creating and acquiring new knowledge and sharing and mobilizing knowledge through organization. The task of accumulating knowledge can be further divided into three subtasks, which are knowledge creation, knowledge acquisition and knowledge retention. The task of mobilizing knowledge can also be divided into subtasks, which are knowledge identification, knowledge outflow, knowledge transmission and knowledge inflow. There are always some challenges in these processes. All of these challenges derive from the dysfunction of social ecology. Boer, van Baalen and Kumar (2004) divide the relationships where knowledge is transferred in organizations in four modes, based on theories from the areas of sociology, social anthropology and social psychology. In this model humans are considered social in nature and arranging their social life according to others, and relations are considered definitive, satisfactory and meaningful. First mode is *communal sharing* which describes group or dyadic relationship which members are equal and focus on common characteristic instead of individual differences. In these groups people think that they own a common factor and thus consider it natural to show friendliness and unselfishness. *Authority ranking* relationships are built on some kind of linear social hierarchy. The higher the rank one is, the more information one has access compared to the individuals at lower level, and they share it when needed. Individual in higher level possess privileges and authority that individuals in lower levels don't. On the other hand, lower level individuals are justified for protection of higher level individuals. *Equality matching* relations are based on reciprocal giving and taking. People are focused on keeping relationship on the balance and observing how far from balance relationship at certain moment is. Everyone, who brings something new in relationship, is expecting to get reciprocal amount back. *Market pricing* relationships people focus on and change their behavior according to how well they are distinguished from others. In these relationships cost-benefit thinking is characteristic. Apart from these four modes of relationships *meaningless relationships*, where other person's conceptions, goals and standards are completely ignored and *asocial relationships* where people use other people just instruments to achieve some end, can be recognized.

The meaningful thing for knowledge system of organization is the fact that individuals, groups and organizations don't always function as other side has expected. These situations may lead to three kinds of conflicts. First, if people share information according to

same mode, but disagree how to apply it. Second, people share knowledge according to different modes, and third the technology and organizational structure does not fit its users' knowledge sharing mode. (Boer et al. 2004: 143–144.)

3.4. Different knowledge environments

It is proposed that different environments require different kinds of actions. Sanchez (2004) suggests that competitive environments can be divided into stable, evolving and dynamic. In stable competitive environment the changes in market preferences and available technologies are minimal. Evolving competitive environment contains progressive and identifiable changes, and dynamic competitive environment frequent and uncertain changes in market preferences and available technologies. He continues that even if organization works like a system, different environments require different focus, for example in the stable environment the focus should be on the operating capabilities of a firm, whereas dynamic competitive environment require cognitive flexibility from strategic managers. Stähle and Grönroos (1999, 2000) and Stähle, Stähle and Pöyhönen (2003: 53) present also three different knowledge environments.

Table 5. Living environments of knowledge (Stähle, Stähle & Pöyhönen 2003: 53).

	Mechanical	Organic	Dynamic
Objective	Permanent efficiency	Gradual development	Continuous innovation
Knowledge	Defined, explicit	Experiential, hidden, tacit	Intuitive, potential
Relations	Determined by organizational hierarchy	Reciprocal, seeking consensus	Spontaneous, networked
Information flow	One-way	Multi-way	Chaotic
Management tool	Orders from management	Dialogue, agreed working methods, self-assessment	Networking skills, visions
Leadership method	Direct use of power	Delegation of power	Relinquishing power

Ståhle and Grönroos (2000: 73–74) state that strategic renewal of resources and innovations at its heart is key factor for maintaining competitive advantage. Innovations are characteristics of an organization, and they are concretized in everyday functions in organizations. Thus, the means of development and growth and the role of innovations differ according how organization functions and is conceptualized. Organization should be viewed as three dimensioned system, which mechanistic, organic and chaotic properties play a role in building competitive advantage.

In *mechanistic environment* (Ståhle & Grönroos 2000: 98–100) knowledge flow is defined by organizational hierarchy. To function effectively individuals must stay in their roles and avoid making mistakes. Everything has to be predictable and predefined, it is the only way to guarantee quality in mechanical environment. This kind of function is still needed as *a part* of modern entrepreneurship, but as a model for organization it is helplessly too old fashioned. *Organic environment* (Ståhle & Grönroos 2000: 103–112) aims for controlled growth and continuous change. This requires constant self evaluation and development. Organic system grows like organism, developing little by little, living and acting in real time. This kind of real time organic growth is needed for example in every customer meeting, where instant reaction for current situations is expected. The great part of individual competence is based on experience and tacit, which can be transferred only by means of dialogue and acting. In organic environment communications between individuals is key for organizational development. The growth of this kind of environment can be steered by sharing knowledge and decision power down in organization and the competitiveness of system is based on human interaction, and top management has to have courage to decrease control and increase trust and openness. Still, the more employee responsibility is increased, the more organizations vision, values and strategy has to be at the centre of continuous discussion and they must be understood by employees (Ståhle & Grönroos 2000: 116–117). *Dynamic environment* (Ståhle & Grönroos 2000: 118) is global and full of changes, which most are out of organizations reach without outside resources. Organizations must face the challenges presented by competitors and competition and only effective way to work is to act flexible, fast, reactive and innovative. Unpredictability and uncertainty are characteristics of this kind of environment. Even if tacit knowledge is still important, the most important thing is to be able to act in a situation where the area of required knowledge is unclear. Development in dynamic environment requires chaos. According to Ståhle and Grönroos (2000: 199–124) this means spontaneity, openness and constant exchange of information. Information exchange must be spontaneous, which leads to increasing chaos and common interest bind people together. This kind of environment is net-

worked internally and towards its outside environment. Its dynamic is based on the vastness of its networks and the quality of its relationships, and maintaining this requires face-to-face interaction or by using information technology.

So it is obvious that generating holistic view of knowledge and its management in organizations is not an easy task. As researchers and practitioners have their own, often subconscious, assumptions concerning knowledge, the underlining assumptions become crucial to understand it. One way to clarify different notions of knowledge could be the examination of different epistemologies.

3.5. Three approaches to knowledge

In this chapter three different approaches to knowledge are presented. These different views to knowledge offer different philosophical explanations to knowledge and learning and processes involved.

3.5.1. Cognitivist notion of knowledge

Central idea in cognitivism is that our mind represents reality in various ways and creates inner representations, which corresponds the outer world more or less. The “truth” is defined by how well our inner representations corresponds the outer world. (Von Krogh & Roos 1995: 12). It assumes that: (1) we “take in” information through our senses which we then use to build mental images that we store in our minds and classify objects, (2) brain is seen as a machine of logic and deduction and it follows that logic is seen as a competence to determine what is truth, based on “if...then”, “not”, “and”, and “or” based reasoning (Von Krogh & Roos 1995: 12–14). Von Krogh and Roos (1995: 21) say that cognitivist epistemology suggests that cognitive competence of organization can be formed through certain formula by given right information available to organizational members’ and the right processing of that information produces similar representations of this world. It is said that this follows the computer and information processing metaphors, presented by Herbert Simon: our brain acts like a computer, as an information processing mechanism which takes inputs from the environments and processes it according to pre-established rules and thus produces outputs (Magalhaes 1998: 97). This can be applied also to organization level, and thus organizations contain representations of the environment and are able to store and retrieve organization wide knowledge structures.

Von Krogh, Roos and Slocum (1994) state that cognitivist approach is interested how representations of the world are created through information processing and how they are stored in knowledge structures. The world is seen as pre-given and the aim of our cognitive system is to give us the most accurate representation of the world. Further, learning means that individual gets representations of this world more accurately. Much of strategic management literature relies on this view. According to cognitivist view, brain acts as a “passive mirror” of reality and the images of outside world are accurately reflected and stored in certain parts of brains (Stacey, Griffin & Shaw 2000: 159). Knowing, knowledge creation and learning happens through feedback processes which try to fix gap between external reality and internal picture of the world (Stacey et al. 2000: 159).

The main idea of cognitivist epistemology, representations, and its accompanying assumptions of transparency of information, ability to process information and competence at logic and probability judgments can be traced back to the studies of organizations and management. At a very general level, several contributions assume that managers create representations of their environment. It is said, that also the cornerstones of management and organizations studies are based on this assumption. (Von Krogh & Roos 1995: 16.)

3.5.2. Connectionist notion of knowledge

Connectionist epistemology started in the realm of computer and brain research. It provided an alternative perspective for cognitivist assumption. The main criticism centered around two things in cognitivists work: (1) information processing was seen sequential, rule-based manipulation of symbols, meaning that one rule is applied after another, (2) information processing was seen localized. If one rule “breaks down or if symbol was lost, it caused several consequences for the global effectiveness of the system. (Von Krogh & Roos 1995: 22.)

Instead of seeing computer as the main information processing machine, the brain was taken on the frame. Instead of sequential, symbol based functioning, dynamic global properties arise in a network of simple components, called neurons. These components are active in their local environments, and are connected to each others. They operate by their local rules, and there are rules for connections of each component. As they are active or inactive in the network, global properties emerge spontaneously in the system

of these components. This behavior was first called “self-organization” and later it got labels such as “emergent properties”, “global properties”, “network dynamics” and “synergetics”. (Von Krogh & Roos 1995: 22.)

Table 6. Role of cognition in cognitivist and connectionist epistemology (Varela et al. 1991: 42, 99).

QUESTION	COGNIVIST EPISTEMOLOGY	CONNECTIONIST EPISTEMOLOGY
What is cognition?	Information processing as symbolic computation-rule-based manipulation of symbols.	The emergence of global states in a network of simple components.
How does it work?	Through any device that can support and manipulate discrete functional elements-the symbols. The system interacts only with the form of the symbols (their physical attributes), not their meaning.	Through local rules for individual operation and rules for changes in the connectivity among the elements.
How do I know when cognitive system is functioning adequately?	When the symbols appropriately represent some aspect of the real world, and the information processing leads to a successful solution of the problem given to the system.	When emergent properties (and resulting structure) can be seen to correspond to a specific cognitive capacity- a successful solution to a required task.

Von Krogh and Roos (1995: 23) refer to Varela, Thompson and Rosch (1991) and say that main issue in connectionist epistemology, understanding the function of brain as a neural network and the emergent behavior that results, is “learning rules”. They continue that in connectionist epistemology, like in cognitivist epistemology, information processing is seen as the basic activity of the brain. However, information processing is seen as happening through stimuli from the environment but also from the brain. Unlike cognitivist epistemology, where learning was seen as always more accurate representation of the world, connectionists see brain as *global states in history-dependent system where the learning rules and the history of connections between components’ affect present connections made* (Von Krogh & Roos 1995: 23). Further, organizational know-

ledge is seen as a state in a system of interconnected individuals which interacts with its environment, meaning that it does not reside inside the each component (Von Krogh & Roos 1995: 24.) As connectionist model focuses on the relationships instead of individual or system, the number of connections, dynamics of information flow and the capacity to store this information characterize the network (Venzin, Von Krogh & Roos 1999: 40).

Fuchs and Hofkirchner (2005) present a model of knowledge in social self-organization. In this model knowledge is seen as a threefold process, which is constituted of cognition, communication and co-operation in social system. Social self organization begins from the cognitive knowledge of the actors involved. All social activity is based on active knowledgeable actors. Communication is used to co-ordinate subjective knowledge of actors, which in turn can result in co-operative processes. Thus interaction of agents and their subjective knowledge produces emergent qualities of social system. It can be said that emergent qualities of social system are objectification of subjective knowledge of actors involved.

3.5.3. Autopoietic notion of knowledge

Autopoietic notion of knowledge suggests that world is not pre-given, it is constantly created by our cognition, and knowledge is connected to our observation (Von Krogh, Roos & Slocum 1994). A key claim of autopoietic notion of knowledge is that world or “situation” and knowledge are structurally coupled and constantly co-evolving (Von Krogh & Roos 1995: 51). The autopoietic notion of knowledge sees that *everything known is known by somebody*. It means that knowledge is not abstract but embodied. As human faces new situations, experiences are gained through sensing, moving, thinking, etc. It follows that knowledge is gained via actions, perception, sensory and motor processes. Further, that what has happened to us before affects the experiences in the future. As we are structurally coupled with the world, knowledge enables us to act, move and perceive the world and as we act, move and perceive, the world comes forth as a result of our actions (Von Krogh & Roos 1995: 50–51). “*This circularity, this connection between action and experience, this inseparability between a particular way of being and how the world appears to us, tells us that every act of knowing brings forth the world* (Maturana & Varela 1987: 26 as cited in Maula 1999: 124). In practice that means that our history defines what we see or consider relevant.

There are two central categories in autopoietic theory, *distinctions* and *norms* (Luhmann 1986; Luhmann 1988; Varela 1979 in Von Krogh et al. 1994: 58). Knowledge enables, for example managers, to make distinctions in their observations and based on their norms determine what they see (Von Krogh et al. 1994: 58). Distinction-making is a process of isolating elements of the world, a process that distinguishes unity from its background, for example a tree from the forest (Von Krogh & Roos 1995: 53). Knowledge is therefore highly dynamic, as managers make new observations, talk and imagine possible futures and courses of action. Increasing knowledge thus enables managers to make finer distinctions and eventually a knowledge structure evolves that resembles a tree (Von Krogh et al. 1994: 58).

For the level of organization, a prerequisite for organizational knowledge to develop is the main distinction between organization and its environment (what do we know about our environment). Social norms are necessary to coordinate the opinions of organization's members as to what they observe (Von Krogh et al. 1994: 60). Von Krogh et al. (1994: 60) give an example of organizational knowledge. When organization is developing knowledge for strategic decision making (direction of action), it is thinking at the *scale* that encompasses all the other scales in organization. However, this level of thought is useless unless it is linked to all the other levels of understanding and eventually implementation at lower levels of organization. Managing this amount of information about would be burdensome for organizational entity. Instead of doing that organizational entity needs only to deal with the processes of distinction making that may occur in each scale of knowledge development and take these into account in its high level knowledge development process.

Available *knowledge connections* are conditions for organizational autopoiesis. Unless there are knowledge connections available, knowledge in certain time does not connect with the knowledge at a later point of time. Two conditions must be fulfilled in order for new knowledge to connect: (1) the availability of relationships and (2) a self-description (Von Krogh et al. 1994: 61). Organizations consist of set of relationships that enable knowledge connections. These can be informal, which carry distinctions made and ensure the development by others, and formal structural and reporting relationships which also allow organizational knowledge to develop. Further, knowledge connections require a self-description. It is suggested that self description formulates the identity of the organization (Luhmann 1990: 253 in Von Krogh et al. 1994: 62). Self-description defines what is considered for knowledge and should be connected and what is considered as "noise" and should not be connected. In organization's descriptions of identity in-

clude business ideas, mission statements, strategy documents, vision statements, management principles and guiding values for example (Von Krogh et al. 1994: 62). Moreover, the one basic character of autopoietic system is its self-referentiality. It is concretized in a phrase *what we know was influenced by what we knew, and what we will know depends on what we know* (Von Krogh & Roos 1995: 40).

Autopoiesis affords new epistemological lens for topics such as a psychological view of learning versus a sociological approach to knowledge; view of management based mainly on rational thought versus view based on organizational power; a top down business-strategy versus bottom-up, emergent approach; and positivistic approach to research versus purely interpretist approach (Magalhaes 1998: 90–91). Von Krogh, Roos and Slocum (1996: 172) see that realization of different corporate epistemologies may help use to re-think strategic management. They divide the activities of organizations in advancement activities and survival activities. Advancement activities consist of developing distinctions and norms, scaling knowledge, processing data, ensuring knowledge connectivity, self-referencing and languaging. Survival activities consist of production-market positioning, planning and deciding, organizing, resource development allocation, routinization and controlling. They continue saying that as both activities are important, advancement activities can be the way for organizations to differentiate from their competitors. Nonaka and Takeuchi (1995: 8) have also noted the challenges of cognitivist approach, and say that many western practitioners take for granted the view of organization as information processing machine. This view has its roots in western management tradition, from Frederick Taylor to Herbert Simon. In this tradition knowledge is viewed synonymously with a computer code, a chemical formula or a set of general rules.

Varela (1981: 20–21) explains cognition of organizationally closed system by comparing two points of views, control and autonomy, which *do a continuous dance*. The fundamental paradigm of our interactions with control system is instructions, and unsatisfactory results are errors, whereas the fundamental paradigm with our interactions with autonomous system is a conversation, and unsatisfactory results are *breaches of understanding*. He continues that the way system is identified and specified is not separable how its cognitive performance is understood. So if control paradigm is taken information is inevitably seen as instruction and representation, which is not necessarily case if system is characterizes as autonomous. This leads to a conclusion that the re-examination of how system defines its own identity is actually examination what informational actions can possibly mean. That leads us to see information as different from

instruction and closer to construction and instead of seeing representation of reality we see the way how adequate behavior reflects viability of the system's functioning.

3.6. Summary of the views of knowledge in organization

It is clear that knowledge in organizations is not a simple concept that is similarly understood in the management literature or literature in general. The questions if knowledge can be formed inside one's mind or does it require bodily action derived from the ancient philosophers are still unanswered. Further, the roles of the tacit and explicit knowledge and the questions if knowledge resides always inside a human being or can it be found somewhere else from the organizational system vary depending on the theory. Based on above mentioned it is not a surprise that different knowledge management theorists emphasize different aspects of knowledge. The ongoing debate also recognizes the social aspect of knowledge. As organizations are collectives of persons, the focus on the knowledge is moving from the individuals to social systems. It is noted that interpretations and meanings in reciprocal relationships are in a great role in knowledge formation. The environment where organization operates sets also different requirements, stability and nature of environment affects on which kind of knowledge we should focus on and how we should understand the dynamics of organization.

Table 7. Three different organizational epistemologies (adapted from the tables of Venzin, Von Krogh & Roos 1999: 39, 41, 43).

Profile criteria	Cognitivist profile	Connectionist profile	Autopoietic profile
View of one's own organization	Works like a mainframe computer, is open for information that is collected and stored centrally, action is steered by the main frame of the top management	Virtual organization consist of individual who are connected mostly through information technology. Action is self-organized and steered by local rules that refer to several frames of reference	The autopoietic company is an autonomous system that is simultaneously open for data but closed for information. It is a group of individuals who have created an emergent frame of reference.
Perception of the environment and positioning in it	The environment is pre-given. The main task for the organization is to represent/picture it and to adapt it universally	Clusters of the organizational network produce different pictures of the pre-given world that form the basis for a differentiated adaptation	The world is brought forth in conversations. The environment and the organization are coevolving systems.
Notion of knowledge	Knowledge is fixed and representable entity (data) universally stored in computers, databases, archives and manuals. Knowledge can be easily shared across the organization	Knowledge resides in the connections of experts and is problem-solution oriented. Knowledge is dependent on the state of the network of interconnected components.	Knowledge resides in mind, body and the social system. It is observer-, and history dependent, context-sensitive and not directly shared, only indirectly through discussions

Knowledge development	The cognitivist develops knowledge through the assimilation and dissemination of incoming information. Inner representations that partly or fully correspond to the outer world are created	Local rules in a network of how knowledge is accumulated. This allows self-organized groups to develop specific knowledge in order to represent their own environment	The process of interpreting incoming data in conversations is the cornerstone in knowledge development. This enables the autopoietic systems to make distinction and to create meaning according to observations and previous experiences
Characteristics of truth	Truth is the degree to which our inner representations correspond to the world outside. Truth is defined as dependent on the amount of information	Different experts who have accumulated information about parts of the objective reality bargain about the truth.	Truth is not a main issue. By accepting that there is not an objective reality, different standpoints are possible. Reality is socially created.

As the research in the competence and knowledge management area shows, there are various ways to approach knowledge. As it is noted (Von Krogh & Roos 1995, Varela et al. 1991), there are different epistemologies concerning the way we understand how we come to know. Sanchez's (1997) model stems from open system point of view. As it is, it is quite managerial and it has many characteristics from cognitivist epistemology. Sanchez relies quite heavily on the traditional management theories, even if it is one of the most flexible ones. The whole new approach could be found from the area of complexity sciences and viewing the organization as autopoietic system. Some approaches have already presented and introduced in this study. According to Jackson (2007) organizational learning can be viewed from autopoiesis point of view, with certain reservations. Maula (2000) studied companies as living systems and identified two major knowledge flows, sensory and memory function of a firm. Kay (2001) provided vast literature review taking social autopoiesis as a starting point. Hall (2005) synthesizes ideas from different disciplines of science and presented an autopoietic framework for knowledge and learning in organizations. So instead of taking a open system principles from physics, it could be fruitful to turn towards biology (the key principles of autopoietic system offered by Maturana & Varela) and take the functioning principles from there. The future research questions could be the many possibilities that complexity sciences offer to future competence management.

4. RESEARCH METHODOLOGIES

In previous pages different ways to understand how organizations work and what is the role of knowledge in these different models has been examined. Three main epistemologies are identified, which all stem from different philosophical assumptions. These assumptions are tacit and difficult for outsider to notice. However, they affect the everyday life of people in the organizations, as those underlying assumptions are concretized in action. First epistemology has common academic history with early systems thinking perspective. Organizations are viewed as open systems, which are in constant interaction with their environment. Open systems are always part of a bigger suprasystem and consist of many subsystems. Managers in organizations have a big role as they guide their own subsystem. Knowledge is considered as commodity and objective and stored in explicit form. Learning is seen to be more accurate representation of this world, which is stored in our knowledge structures. The second epistemology derives from the brain and artificial intelligence research and sees organizations as neural networks. It lacks a central modifier, agents in neural networks self-organize around attractors based on the encoded rules. Knowledge resides around the organization in connections of its members and is based on the current state of network. The third epistemology views organizations as autopoietic entities. Autopoietic entities are simultaneously open and closed systems, open for data but closed for information and knowledge. These entities cannot be controlled, by specific information, environment can only trigger change. These entities are autonomous systems, and change must be started inside the system. These entities cannot be separated from their environment, as they always co-evolve with it.

Table 8. Summary of the knowledge epistemologies.

	Cognitionist	Connectionist	Autopoietic
Organizational epistemology	Information processing, rational decision making	Neural network, self-organization	System with closed identity and changing structure
The most important competence knowledge	Tangible information from organization through control loops	Knowledge in the network of units and individuals	Due to the organizational closure, only data is received
Knowledge resides in	Top management owns knowledge,	Collective network, in connections	Knowledge is created at the mo-

	gets information from organization		ment, just in time
The producer of knowledge	Middle managers carry information	Rightly coded network	Actor itself produces knowledge through conversations
Transfer of knowledge	Mechanistic	As network learns	Its constructed in conversations

These three different epistemologies have influence to the organizational life daily. The questions rise how organizations see themselves, and moreover, how different functions and individuals in organizations see themselves and how they fit with other epistemologies in organizations. In the next chapter some main issues concerning competence and knowledge is now discussed and empirically tested. Based on the theory presented in previous pages, interpretative frame is formed.

In this study epistemologies are studied from knowledge and competence management perspective. Thus three actors were chosen which were considered as the most important: supervisors, HR level and strategic management. These three were chosen as they have the biggest influence for the organization wide competence and knowledge management and its implementation in practice. Following questions are proposed in order to find an answer to main epistemological question, which epistemologies are prevailing in organizations and how three central actors from competence perspective think they come to know.

Table 9. The framework for empirical research.

	Function	Supervisor	HR	Strategic management
	Epistemology			
The role of a function	Cognitive			
	Connectionism			
	Autopoietic			
The way competence	Cognitive			
	Connectionism			

related knowledge is seen	Autopoietic			
How learning is seen	Cognitive			
	Connectionism			
	Autopoietic			
How competence is seen	Cognitive			
	Connectionism			
	Autopoietic			

Moreover, this chapter describes the methodology used in this research and it clarifies the reasons why certain research methods were chosen. Further, research approach, research design, data collection and data analysis are discussed.

4.1. Research approach

There are two main approaches to choose when one is doing a research: qualitative and quantitative research (Hirsjärvi, Remes & Sajavaara 1997: 131). The objective of this study was to examine how the most relevant actors from competence perspective in organizations receive competence related knowledge. For this purpose qualitative research method offered best tools. Qualitative researchers stress the socially constructed nature of reality, the intimate relationships between the researcher and studied subject and situational constraints that shape the results and they focus on the question *how* social experience is created and given meaning (Denzin & Lincoln 2000: 8). Quantitative researchers on the other hand focus on the measurement and analysis of the causal relationships between variables instead of processes. Their assumption is that their work is done within value-free framework (Denzin & Lincoln 2000: 8).

Approach used for analyzing the data was content (data) analysis, which is the basic analyzing method for all qualitative studies (Tuomi & Sarajärvi 2002: 93). Content analysis is text analysis and its purpose is to find meanings in the text (Tuomi & Sarajärvi 2002: 105-106). Content analysis was chosen as the studied phenomena, competence, knowledge and epistemologies were rather abstract constructs and not easily visible, and content analysis provides a method to find and interpret the underlying mean-

ing. Moreover, according to Tuomi and Sarajärvi (2002: 106) content analysis can be based on the relationship to the world which of crucial thing is to understand invisible concepts.

4.2. Research design and data collection

Interviews were used to collect data from participants. It is said that interview is unique data collection method as it makes direct linguistic interaction possible with the research subject (Hirsjärvi, Remes & Sajavaara 2007: 199). Six interviews were made face-to-face in the organizations and five through the phone. The average interview lasted 30–45 minutes and interviews were recorded with a tape recorder and later transcribed verbatim. Total amount of interview material was 71 pages, using the font Times new roman with line-space 1,5. Semi-structured interviews were used as a data collection method. As the concepts “knowledge” and “competence” have different meanings, semi-structured interview provided the best alternative to discuss with these topics with respondents.

Table 10. Respondents.

Respondent number	Industry	Position
1	Service	HR Director
2	Service	Service Manager
3	Service	Area Manager
4	Production	HR Director
5	Production	HRD Expert
6	Production	Branch Director
7	Production	Supervisor
8	Retail	HR Director
9	Retail	HR Consultant/ Training
10	Service	Supervisor
11	Service	HR Consultant

Size of the organizations ranged from 400 employees to +20 000 employees. Respondents for the interview were chosen carefully from participating organizations. Four of the respondents were members of executive board, six respondents were part of the HR

function and five worked in the line organization in different levels. Due to the different organizational structures some respondents belonged to two categories, for example all the HR directors were also members of the executive board. All the respondents were experts on their own field.

The questions in the interviews concerned competence and competence related knowledge in the organizations. Respondents were encouraged to answer the questions based on their own interpretations of the questions. Questions asked in the interviews were for example “how competence management is seen in your organization in strategic management level, in HR- function or in supervisor level?” and “who produces the most critical competence related knowledge in strategic management level, in HR- function or in supervisor level?” and “how the most critical competence related knowledge is transferred to the strategic management level, to HR- function or to supervisor level?”.

The interviews were done successfully, vast majority of the respondents were eager to answer presented questions. At supervisor level concepts of competence and knowledge were seen as concrete phenomena that concretized in the everyday work. Thus, answering the questions at this level didn't cause much trouble. Main challenge was sometimes a too narrow understanding of the terms. Understanding competence and knowledge at unit level varied from allocating the resources and budgets to mastering of certain post in the factory. However, respondents in more strategic positions struggled a bit with the abstract nature of the concepts of competence and knowledge, but eventually all respondents were able to answer the presented questions. Still, even if the industries of the participating organizations in this study differed, the term competence was not unfamiliar, even if it was sometimes hard to explicitly explain.

4.3. Data analysis

The meaning of qualitative analysis is to add information value for a researched content by creating meaningful information from a dispersed data (Tuomi & Sarajärvi 2002: 110). The course of the analysis of this study followed the view of Miles and Huberman (1984) about qualitative analysis, where the process is seen through three iterative phases: data reduction, data display and conclusion drawing/verification.

According to Miles & Huberman (1984: 21), data reduction is seen as a process of refining raw data by selecting, focusing, simplifying, abstracting and transforming gathered

data. It is a process that happens continuously during the research process, as researcher makes choices concerning the data. It is not separable from analysis, as the choices made affect the result. In this study data was first coded in order to get all the references to strategic management, second time to get references to HR and third time to get references to supervisors.

Data display can be defined as organized assembly of information drawing and action taking (Miles & Huberman 1984: 21). In this study, data was organized in different kinds of matrices to clarify the vast data. First matrix consisted information how competence was seen in organization's three different functions, what was seen most critical competence related knowledge in these different functions, and the sources of competence related knowledge. These displays of data helps researcher to understand what is happening and to take actions based on that new understanding (Miles & Huberman 1984: 21).

Third part of the iterative cycle, conclusion drawing and verification is place for deciding what things mean, noting regularities, patterns, expressions, possible configurations, causal flows and propositions (Miles & Huberman 1984: 22). In this study, conclusions were made based on the studied theory and sorted empirical data. As the process continued, more careful classifications were made, new matrices were formed and thus the final results were achieved.

5. FINDINGS

In this section empirical findings are presented. Chapters are divided according the division made in this study between supervisor, HR and strategic management level. Further, the main research question is answered with the aid of supporting questions and three epistemological views are compared to the findings.

5.1. Supervisor level

First examined level is the level of supervisors and how their role is seen in the organization and its competence management system. As the size and industry of the organizations varied, supervisors' role varied from leading the small group of experts to leading a whole unit.

5.1.1. The role of a function

The main role of the function from competence management perspective was seen as knowledge processor and analyzer in unit level. Moreover, supervisor's role was considered to be to connect people with the processes. This was not seen as an easy task, as supervisors were expected to understand own unit's processes and concrete working environment and obey the cost frames presented from above the organization, but also understand the people in the unit, know their individual strengths and weaknesses. The main tool for that was found to be development discussions, which were seen as a way to concretize the competence management process.

The most common notion of the role of supervisor level was seeing it as an operational function. Understanding how operational things work best in supervisors own unit was considered important.

“...if we go down to the supervisor level, closer to actual work, could we say closer to the smell of sweat, it is not that important to remember whole strategy of organization, there you focus more deeply in your own [unit's business], that what does it mean in this unit, what does it mean for me as a supervisor, that he and he can do this and this thing, and [what does it mean for] this goal that I have been given. .” Branch Director

“...our supervisors must be specialists in human resources, so to speak, that they can discuss with employees and that kind of leadership it is nowadays, of course we have to know our processes, how this mail delivery works, how we get our cars and everything like that, that is our technical competence, but clearly that, how we manage to use our processes with those people, that is where we need competence and competence development.” Service manager

“...and when we think about our teams and how you choose who goes in which team, and how this whole action and process is organized, then you have to be aware what is the competence level for each member and not only the competence but also the readiness to achieve competence [in the future].” Supervisor

5.1.2. The way how competence related knowledge is seen

Competence related knowledge in supervisor level is seen as in-depth understanding of own unit's functions which comes on the other hand from the individuals in the unit and on the other hand from upper levels of organization. The knowledge that comes from own unit is considered as knowledge of the present actions and current situations, as the knowledge coming from the higher parts of the organization is considered to be more strategic, future oriented knowledge. In most responses competence related knowledge was seen to present itself in everyday work. On the other hand it was seen tacit and situational and on the other hand as hard and general factual knowledge.

“...we have to transfer, like if old and experienced employee is about to retire and we know, that he has that kind of knowledge that you can't find from books and covers, so we have to identify at pretty early stage who could be that kind of person who would be his successor and what we expect and look from him and then we put him next [to old employee] to grow long enough time that the knowledge is transferred...” Branch Director

Knowledge is seen as a combination of tacit and codified knowledge. Tacit knowledge is created in everyday work, during meetings and discussions. The main channels were thought to be normal interactions between the people in the unit and other supervisors. Both formal and informal discussions were seen important.

“...he [supervisor] has the knowledge; he has seen it through the [subordinates] performance of duties, he has discussed it in development discussion meetings, so he has it...” HR Director

“...it is nearest supervisors “gut feeling”, it might be the wrong word, but knowing them [subordinates], and what we got from the daily interaction, plus development discussions, but maybe development discussions are more for exploring what direction those people want to go and what they want to learn next...[] but existing knowledge is shared between supervisors, what kind of person they each are and what they are competent at... It is a little bit a feeling-based thing.” Supervisor

“It is brought forth in daily basis, when supervisor, the one who is taking part [of action] and whole work community is working openly, so it [knowledge] will come in daily work and department meetings and in development discussions, so that’s how it should work...” HR consultant

Competence related knowledge was seen as a mainly tacit knowledge, which supervisor has acquired through his/her experience in the unit. Acquisition of this knowledge was considered happening at least partly unconsciously, through everyday work.

5.1.3. The way competence development is seen

Important thing in knowledge development was seen to be the implementation of strategies in the concrete level. One factor for that were the processes and structures that had been followed. Development discussion process and the proper execution of it rise from the interviews.

Also, the importance of tacit learning during the everyday work happening in discussions with subordinates and colleagues was also considered important.

“our supervisors has to be professionals at managing people, as they say, they have to be able to discuss with their employees, and that’s the kind of management it nowadays is, of course we have to know how our processes function, how delivering the mail happens, what time our cars come, and stuff like that, that’s our technical competence, but how we get our

processes work with those people, that is where we need competence and competence development...” (Service manager)

“...supervisors have a critical role that [it is possible to] build this kind of work community and maintain it and show example, by developing themselves [they] give examples to others, that responsibility is individual’s but supervisor must create the setting that there are prerequisites for development.” Supervisor

“We have profile goals and in development discussions supervisor and subordinate go through it, they decide together what is the level of the goal, where I [subordinate] have reached the goal and where do I have something to improve. So we can say that this competence management is just technical management tool, in practice it is communication between supervisor and subordinate and the understanding between them, and this technique helps us to concretize it so it doesn’t get stuck just in the abstract level.” HR Director

5.1.4. How competence is seen

Competence at supervisor level was seen as understanding of how own unit works at the most optimal way. It was considered to be holistic, understanding of own unit’s strengths and weaknesses. The focus was thought to be in the role of a unit and how things happen in the unit, the strategic competences were seen not that important.

“In theory we can think that in supervisor level the strategic competences are notified, but in practice it doesn’t happen that much, strategic competences are that kind that they don’t necessarily reach the unit level. In there they think what kind of competence they need in our function today and hopefully especially in tomorrow, but it might be pretty much reactive, actions happen here and now.” HR Director

“We have that kind of thing in here that our competence in organization has spread into quite wide area... []...and this kind of organization it is extremely important how these different areas function with each other, how we cooperate with production, how to make cooperative work with product de-

velopment, not to work together with automatic-technique, these things create the biggest challenges for this kind of organization, for us, it means that one person can't develop alone unless he work together with employees from these different areas.” Supervisor (manager)

5.2. HR level

The second examined level is the level of HR function and how its role is seen in the organization and in organization's competence management system. The HR functions and their roles in the organizations were naturally different due to different business areas, but similar enough to make comparison.

5.2.1. The role of a function

HR's role in the organizations was considered as a bridge builder between different functions and strategic management. Further, it was considered to be responsible for competence management process, trying to make competence management processes more concrete in unit level. Often there was also a member from the HR function in executive board, making the knowledge transfer between the levels easier. Moreover, HR was seen to be the collector of information and knowledge around the organization, thus helping functions to make decisions.

*“...competence management, with this new project, we [HR] have tried to clarify and concretize the whole project and get all the needed directions done...[]...so supervisors should have clear conception what competence management is, why we are doing it and what is the time scale for this...”
HR Consultant*

“...there is those requests and questions from strategic management, like how new business or merger of businesses would work, so there is a hurry to find out where that kind of competence possibly would be, it is like going to fishing with nets on the water, where to get knowledge, so for HR it means finding right people in practice and also finding the potential of new people, like this [employee] is not ready [competent employee], but he is so potential and proved his ability elsewhere...[]...so we do this potential mappings far enough, we are getting ready for new world and new business

and we have moving space there. We come to the individual level on competence and different group level, where we can start looking for that competence.” HR consultant

5.2.2. The way competence related knowledge is seen

HR receives the knowledge of competence from different parts of the organization. The knowledge of competence is seen on the other hand as the competence of individual units, provided by the managers of those units, but on the other hand also as in the form of strategic competences coming from strategic management. As the role of a HR was considered as bridge builder between the units, the knowledge of different repositories, systems and forums the knowledge of individual competencies were gathered and further compiled and provided to strategic management.

“...the competence we have at the moment, the knowledge comes from team leaders, through those discussions, and what the competence is, we get continuous numeral reports what kind of people we have and how it has changed, and these pieces of information come to us and HR should be able to refine it and produce it to strategic management, but the knowledge where we should go and how we are going to achieve it, that’s the strategic management’s job.” HR Consultant

“I represent that kind of school of thought that the most critical competence related knowledge resides in the business unit and they know and they have to know where to go, what kind of competence is needed and then of course HR function’s role is more to listen what is happening outside of the organization, what kind of trends are coming...[...] this kind of impulse [from business unit] comes to us in HR so we can immediately answer, we know what are the ways how we can achieve this kind of competence and on the other hand support that that kind of competence really is created.” HRD Specialist

“...through normal communication and action it [knowledge] comes to HR...from bottom-up but also through collegial networks and HR networks and from top management’s development discussions... so it is constant communication process, it is not, at least at the moment, one simple package

that we do, it is always dependent on the situation and HR needs to have own competence depending on the situation that where from your network you will start searching for certain needed competence.” HR Consultant

5.2.3. The way competence development is seen

HR was considered to be in the linkage between strategic management and supervisor level. Therefore it was considered important that HR possessed the knowledge of what kind of competence was needed in the organization. Further, HR was thought to be in the middle of competence web, in a place where it gets knowledge from supervisors and from the strategic management but also from different forums, meetings and through benchmarking. Eventually competence development was thought to be ordinary work in HR which happens formally through development of different processes and structures but also informally through communication and conversation around organization.

“...from the HR point of view that information, what affects the actions of HR, what kind of competence should be developed, the competence development view is if we need some kind of process knowledge in some part of a process, do we need some kind of car driving competence in somewhere... For HR the most pertinent thing is to get to know what kind of knowledge [competence] it should be focus development [in the organization].” HR Director

“...our local human resource managers and directors are always involved in planning what happens [in competence management] locally, then for many years our central organization has organized field training, we have done that kind of ground breaking work here [to choose] what kind of supervisors we should choose to grow in our company, I mean those people that come straight from school, and then our local supervisors focus on to the local potential talents who have a practical background...” HR consultant

5.2.4. How competence is seen

At the HR level competence was considered to be future oriented, strategic knowledge about competence needs in the organization. To achieve that knowledge the prerequisites were that HR was true partner of strategic management and part of the strategy

process. The importance of the identified strategic competences in strategic management was considered important for HR to fulfill its function.

“... I would say that the A and O of everything is the clarity of strategic competences, the unity of strategic vision, after that competence management is just operational actions. But if these Matti and Maija don't know what they want, we [HR] can do whatever we want with this competence management. By Matti and Maija I mean the members of the executive board, if executive board doesn't know what it wants, we can practice whatever we want under the label competence management.” HR Director

5.3. Strategic management

The third examined level is the level of strategic management and how its role is seen in the organization and in organizations competence management system. Strategic management was understood as consisting of the members of executive board in this study.

5.3.1. The role of a function

Overall respondents saw the role of strategic management future oriented as expected. It was seen responsible for determining strategic competences in the future and guiding organization with the definition of policies.

“...to create strong enough strategic view for every moment and take environmental changes into account, what is happening in the surrounding world, and what are its effects on us. And then, what are the requirements for our doings, create the vision, what we want to be in five years if the world keeps changing, and realize the gap between what we are doing now and where do we want to be in four-five years...[] ...if I think about my role, it is to create vision what we should be, identify the holes between [vision and present situation] and the after that divide the resources right, that we can achieve our vision in few years. After that I have to take care that things start going to the right direction, it is pretty much operational work for me also, and after that point, I have to provide strong enough view of the strategy created for my own subordinates and take them along to the doing, so

that middle management would get clear picture of where the world is going and what does it mean for us, and that way create the common commitment, that we must do this kind of things in order for each of us to achieve the created vision. ” Branch Director

5.3.2. The way competence related knowledge is seen

Competence related knowledge in strategic management was seen as in-depth knowledge about strategic competences in organizations. Respondents saw that knowledge in strategic level should be knowledge about competencies in organization, knowledge about knowledge in organization.

“...if you think about it from strategic perspective, it is of course [the question about] what our competence level is now and regarding to future, what are the challenges in the there... so there is two sides, what do we have at the moment and what we will need in next five – ten years and of course the knowledge about how retiring employees affect to our competence level in organization” HR Consultant

“...we have changed our competence management process, we have moved from individual competencies to different viewpoint...[]...at the moment we are in the middle of the process, we get group level [information] about competences, we get through those conversations in groups information about what the competence level is at that group at the moment and how they feel the needs are in the future, from there the summary of competence level comes” HR Consultant

“My point of view is that strategic management makes strategic decisions and creates long term vision, then it [the most important knowledge] is of course [the question] do we have that kind of competence, that we can build on.” HR consultant

5.3.3. How competence development is seen

Competence development was seen happening through the structures and process in strategic level. Top management influences by its decisions how competence development happens.

“...these service manager meetings, development group meetings and these weekly meetings, knowledge transfer should be like that, all the time we should transfer knowledge so that it would be transferred in a right relation...” Service manager

“.. but it [knowledge] should come through dialogue from strategic management and not just by using “management” style, what it tend to be, if you are not active yourself and surf in the web the knowledge transfers quite badly.” Area manager

“...if I speak about customer-orientation, we can all say that customer orientation is ok, but when we start to implement it down to this organization, the we have to define, for example, in sales and marketing [function], what does customer-orientation mean in sales, what does customer-orientation mean in brand building, what does customer-orientation mean in consumer research... so in there [in the units]they open the most critical competence, what does it mean under this “umbrella”... and then we have set the goals, made profiles... we do our competence management through profiles, what does it mean in my position that I have to be competent at, and then in development discussions we go through it how I fit the profile, what were the deficiencies... so how well we can combine the competence levels and where the gaps are.” HR Director

“...we [strategic management] should be able to analyze what we should know and also help managers to ask that thing from their subordinates, like that these five things are core things in sales competence, like you can identify leads, you can find prospects, you can do this and that, so the structured knowledge comes from above and agents in organization provide the knowledge...” HR Director

5.3.4. How competence is seen

The final knowledge in strategic management was seen to be created during the strategy making process, where every member of executive board brought his/hers knowledge into the process. This was also articulated quite clearly:

“...in every year during the strategy process strategic competences are defined and at the same process you have to define the level of competence [in organization]” HR Director

“There have to be working information channels open at every direction and normal conversation, I think that at least in our cooperative store level the executives team’s discussions, conversations and meetings [are ones], and HR manager has important role there to filter knowledge from supervisor level, but that every branch director has own team and subordinates, so the knowledge should come through the everyday communication.” HR consultant

“...it is written in our corporate values, competence is one of the values and it is articulated in our strategy, and through that way, along with this project also, we have started to implement and concretize it [to our organization] as a one of the strategic things in last year.” HR Consultant

“It is written in our vision, to be number one in competence in our business...[...we search best practices from there [from whole industry, not just from one segment] and we try to be forerunner, number one that way, it means that we cooperate with these other companies in [certain industry] and we follow what happens there and share the information...”HRD Expert

5.4. Summary of the interviews

In this section three different functions are examined in the framework presented earlier in this study and some conclusions for the question how and why functions come to know and how it connects to presented epistemologies are presented. The metaphoric level in the framework is taken, as it would need deeper analysis to claim that functions

really are acting as cognitive, connectionist or autopoietic entity. Different ways to see how functions achieve their knowledge are investigated through the three aforementioned, cognitive, connectionist and autopoietic metaphors.

Supervisor level comes to know according to the answers by through the conversations and communication in their daily work. It comes close to the term “*linguaging*”, as the meaning and knowledge of individual competencies in the unit are discussed. Moreover, the way how supervisors get to know their supervisors and how they create shared meanings should be noted. Thus, autopoietic nature of knowledge would come into a question. However, the answer for the question why supervisor level comes to know could be seen as its purpose to fulfill its role as operational motor. It also resembles open system in a way as information is received from higher levels of organization; it is accepted and transferred according to prevailing settings into an output in the form of products and services. Further, the interpretation of competence in supervisor level can be seen from two angles. First, competence can be seen based on a feedback processes in a system which corrects the actions if the defined processes and procedures are not followed. This would be the cognitivist view. On the other hand competence can be seen as a state in the unit, construed of its members, where everything works fine and corrections happen through individuals decision based on the prevailing rules. This resembles more connectionist view.

The role of HR connects most clearly to connectionist epistemology. HR comes to know through their network around the organization. Its purpose is seen as a bridge builder between different functions. HR receives information through its agents around the organization, who act independently in the organization. On the other hand, cognitivist characteristics can be identified as some information is stored in repositories in the central databases. Moreover, autopoietic nature of knowledge can be identified as in some cases common understanding is created during the communication around organization. It could be said that the role of HR was thought to be most clearly connectionists, web-like, even though it had some autopoietic and cognitionist characteristics.

Table 11. Overall.

	The role of a function	The way competence related knowledge is seen	The way competence is seen	The way competence development is seen
Strategic management	Governor of competence related knowledge Creator of future strategies	Understand the prerequisites for strategic competences in organization	Strategic competences As abstract, guiding concept	Through structures and processes
HR	Bridge builder between the functions	Gathered/residing in/ from the networks	Knowledge of competence needs in organization	Everyday work in HR function
Supervisor level	Operational motor	In-depth knowledge of employees in unit and processes of organization	Holistic understanding how the unit works	Happening through development discussions

Strategic management was seen to come to know through the knowledge creation in strategy making process. Its function is to act as a governor of competence related knowledge and to provide future strategies. This whole concept implies cognitionist notion of knowledge. However, the strategy making process can also be seen as an autopoietic process, as all the heads of the functions bring their own knowledge about organization in the strategy process, and common understanding is thus created. It could be said that level of strategic management was thought to resemble most of cognitive epistemologic view of knowledge. Still, it had some references to autopoiesis

6. CONCLUSIONS AND DISCUSSION

In this chapter the findings of the study are summarized and concluding remarks about the study are presented. Moreover, future research topics from the area are suggested. In addition limitations of this study are presented.

6.1. Conclusion of the study

The main research question of this study was *“how and why the most important actors in organization’s competence management system come to know”*. The theoretical part of this study examined first the system theories and identified three main theories that act as a basis of different knowledge epistemologies. Thus, cognitionism, based on the open system view of the organization deriving from computer science, connectionism, based on the cognitive sciences, brain research and artificial intelligence research and autopoiesis, based on the biology and research of living systems, especially cells, were presented. Further, their implications in the literature as organizations’ models and frameworks and their relevance in building competence in organization were introduced. Also different ways how to interpret knowledge in the organizations were discussed and most common theories of knowledge and its management were presented. Moreover, the epistemological differences in the area of knowledge in the organizations were highlighted. Finally, interpretative frame was presented based on the previous theories.

- Empirical findings were divided between supervisor, HR and strategic management levels. In supervisor level, the main role was found to be to work as an operational motor in the organization. The understanding of own unit’s functions were considered to be the most important things in supervisor level. The knowledge of the subordinates was considered crucial in order to get thing work in the unit. Also the understanding of the processes and the way how to motivate and connect unit’s employees to the processes was seen important. Competence management was seen happening through the everyday work and most importantly in development discussions. It could be concluded that the supervisor level came to know through the communication in their daily work.
- In HR level the main role was found to be to act as a bridge builder between functions. The knowledge around the organizations was achieved through the

networks, and some part of the knowledge was seen residing in those networks. The knowledge of competence needs in organization was considered important as the role of the function was in most organizations also to develop competence. Thus, competence development was seen also as the everyday work in this function. It could be concluded that especially HR comes to know through their networks.

- Strategic management was seen responsible for the creation of the future strategies. Further, it was seen as a governor of competence related knowledge. The most important thing to know was seen the understanding of the prerequisites for strategic competences. Competences were seen in to manifest themselves as an abstract, guiding, concept, for example in the organizations vision and concretize themselves in the strategic competences. Strategic level was also responsible for planning structures and processes for competence management.

6.2. Theoretical contribution

Theoretical framework was constructed on three different views on systems. These views were based on different philosophical assumptions, based on different areas of science. The basis of these different fields rests on different streams of thought, all of them considered tenable. Current resource –based thinking and its knowledge and competence management implications acted as another theoretical construct in this study.

The contribution of this study was to bring underlying assumptions and ways of thinking to the competence and knowledge management discussion in prevailing literature and practice. Especially the effect of different organizational epistemologies is presented as one of the rarely noticed factors. Also, the integration of the fields of knowledge and competence management and their interconnection and the role of system theories in this is pointed out.

Further, the contribution of this study was to provide further understanding of systems thinking in the area of competence and knowledge management and provide a new view point to the discussion. Moreover, the systems thinking perspectives can offer a framework on the connectedness in organizations, for example connecting individual competences and organizational competences together. As these frameworks connect macro and micro levels together, it can also connect organizations' HR and strategic point of

views together. Last, seeing organizations through systems framework enables us to see organizations as dynamic systems with difficultly defined boundaries, consisting mainly of human beings, who make constant interpretations of their surrounding environment, based on their individual and social history.

6.3. Contribution and challenges of empirical research

The purpose of this study was to compare and test theoretical framework to empirical findings. The studied subject was theoretically interesting and empirical research was also interesting, although there were also some challenges on the way. In order to produce material for testing the theoretical framework some difficulties could be identified. Knowledge, competence and systems are quite abstract concepts, and sometimes the respondents found it hard to explain them. Still, respondents were able to form some kind of answer related to studied questions almost every time, even though the understanding of those concepts differed a bit. On the other hand, some pieces of knowledge were hard to explain explicitly, for example thoughts about strategic competences, as they encompass vast, system wide knowledge, and understanding those requires a certain level of knowledge of organization in question. The material gathered from respondents was further analyzed using the content analysis as the research method. In general respondents were able to produce asked material, i.e. respond to answered questions. Still, the challenges in this kind of research lay in the gap between the rhetoric and reality. For a practical point of view, this study shouldn't be interpreted as an absolute truth. Rather, this study should be viewed as a reflection of current organizational rhetoric that is going on in the field of knowledge and competence management in the participating organizations.

Some limitations of this study can be identified. One of the limitations of the study could be the inexperience of researcher. In qualitative study interpretations are constantly made and the role of the researcher should always take into account. The size difference between the participating organizations is not necessarily a limitation, but it should still be taken into an account. The main purpose of this research was to find out the epistemological assumptions of each of the functions and compare those to theoretical framework. Especially the comparison of different epistemologies to theoretical framework was found to be challenging task. The answers of the respondents were analyzed and with the aid of supporting questions groups were formed. The problematic part was to conclude unified views of each of the functions. It was possible to categorize the

functions by how they were seen under the labels autopoietic, connectionistic and cognitivist. However, all of the functions had on the other hand autopoietic characteristics, connectionist characteristic and cognitivist characteristics, based on the answers of respondents. Thus, as it is in the qualitative studies, subjective interpretations by researcher had to be made.

6.4. Future research suggestions

The research topic was interesting and arising. The concepts of autopoiesis and complex systems, systems theories in general and the holistic view of the organizations were increasingly studied. As this study studied all of the three different paradigms and their implications in organizations, it could be fruitful to study just one of these paradigms deeply in one organization, and the way how it is demonstrated in practice. This study was done as a multiple case study, but in future case- or action research could provide good insights for internal life of organizations. Further, content analysis was used in this study, but alternative research methods could clarify the organizational dynamics more clearly. Discourse analysis could be used to examine more closely why certain discourses concerning the different systems and epistemologies are prevailing in organization(s), or narrative analysis could be used to describe how a certain epistemology or way of system thinking is chosen as a leading narrative in organization. Moreover, consequences of thus formed prevailing organizational reality to organizational behavior and strategic choices would be interesting topics for a future research.

This study also aroused the question of philosophical assumptions in organizations. As unconventional for business research it sounds the philosophical questions for example about the truth and knowledge are concretized in organizations. The main philosophical streams like Kant's, Hume's, Heidegger's, Husserl's, Popper's and Kuhn's ideas may still provide some insight to organizational life. For example Popper's idea of three worlds is already basis for some authors (Firestone & McElroy 2005; Campos 2008) in knowledge management instead of some traditional knowledge management theories. Further, as our life in general and in organizations is getting increasingly complex and fragmented, postmodern philosophers such as Derrida, Lyotard and Foucault could provide a fitting philosophical framework for further studies of organizational systems, competence and knowledge. For example Juuti and Luoma's (2009) book (in Finnish) summarize how strategy and postmodernism fit together. Finally, Eastern way of thinking has been quite popular, almost trendy, after Nonaka and Takeuchi's (1995) book,

and for example Varela (1991) provides an insight into the Eastern philosophy. Still, the question of Eastern, collective thinking versus Western, more individualistic way of thought, is still current.

In general, the future research on knowledge and competence management should understand the implicit assumptions that it makes when certain choices with research methodologies, topics and focus of research are made. Based on this research, different epistemological assumptions are constantly made in theory and in practice. Further, the future research could benefit by taking complexity sciences, autopoiesis theory and complex responsive processes into account when new approaches to competence and knowledge management are discussed. For example autopoietic notion of knowledge could form a dynamic but strong basis for understanding knowledge in organizations. Moreover, theoretical implications of competence management system based on autopoietic notion of knowledge, embracing the co-evolving nature of individuals and collectives could bring a new view for competence management discussion. Finally, future studies could benefit the understanding of holistic nature of these theories which illustrate the interconnection of individual human action in organizations to complex, changing world.

Last, practical implications of this study for understanding knowledge and competence in organizations now and in the future could be the understanding the existence of different realities people in organizations live. These realities stem from individual identities and are not easily changed. However, everyday interaction, communication and discussions in organization mold social reality individuals live in, and thus form also the individual reality. When knowledge and competence management systems are planned in organizations these aspects should be taken into consideration. Apart of seeing organizations as knowledge creating systems the underlying level should be also noted, seeing organizations' as reality creating systems, where current dominant reality guides all actions.

REFERENCES

- Aeh, R. (1989). Connectionism: looking into the future. *Journal of systems management* 40:4, 23.
- Alavi, M. & D. Leidner (2001). Review: knowledge management and knowledge management systems: conceptual foundations and research issues. *MIS Quarterly* 25:1, 107–136.
- Anderson, P. (1999). Complexity theory and organization science. *Organization science* 10:3, 216–232.
- Arthur, W.B. (1996). Increasing returns and the new world of business. *Harvard business review* 74:4, 100–109.
- Arthur, W.B. (1999). Complexity and the economy. *Science* 284:5411, 107–109.
- Arthur, W.B., D. Lane & S. Durlauf (1997). Introduction. In Arthur, W.B., Durlauf, S., Lane, D. *The economy as an evolving complex system II*. Proceedings volume XXVII. Santa Fe institute. Studies in the sciences of complexity.
- Baets, W. (2004). *Une interpretation des processus organisationnels d'innovation:un propos scientifique*. Paper presented at seminar 16.7.2004, Marseille.
- Blackler, F. (1995). Knowledge, knowledge work and organizations: an overview and interpretation. *Organization studies* 16:6, 1021–1046.
- Boer, N-I., P. Van Baalen & K. Kumar (2004). The implications of different models of social relations for understanding knowledge sharing. In: *Organizations as knowledge systems:knowledge, learning and dynamic capabilities*, 130–153. Ed. Tsoukas, H. & N. Mylonopoulos. Hampshire: Plagrove Macmillan.
- Bontis, N., M. Crossan & J. Hulland (2002). Managing an organizational learning system by aligning stocks and flows. *Journal of management studies* 39:4, 437–469.

- Booker, L., S. Forrest, M. Mitchell & R. Riolo (2005). Introduction: adaptation, evolution and intelligence. In: *Perspectives on adaptation in natural and artificial systems: essays in honor of John Holland*. Ed. Booker, L., S. Forrest, M. Mitchell & R. Riolo. Santa Fe Institute. Studies in the sciences of complexity.
- Boulding, K. (1956). General systems theory: the skeleton of science. *General systems*. Yearbook of the society for the advancement of general system theory 1, 11-17.
- Bove, K., H. Harmsen & K. Grunert (2000). The link between competencies and company success. In: *Research in competence-based management*. Ed. Sanchez, R. & A. Heene. Stamford, Connecticut: Jai press inc.
- Campos, L. (2008). Analysis of the new knowledge management: guidelines to evaluate KM frameworks. *The journal of information and knowledge management systems* 38:1, 30–41.
- Choo, C.W. (1998). *The knowing organization: How organizations use information to construct meaning, create knowledge and make decisions*. Oxford/New York: Oxford university press.
- Cilliers, P. (1999). *Complexity and postmodernism: understanding complex systems*. London/New York: Routledge.
- Cohen, W. & D. Levinthal (1990). Absorptive capacity: a new perspective on learning and innovation. *Administrative science quarterly* 35:1, 128–152.
- Crossan, M., H. Lane & R. White (1999). An organizational learning framework: from intuition to institution. *Academy of management. The academy of management review* 24:3, 522–537.
- Crossan, M. & I. Bedrow (2003). Organizational learning and strategic renewal. *Strategic management journal* 24:11, 1087–1105.
- Davenport, T. & L. Prusak (1998). *Working knowledge: how organizations manage what they know*. Boston: Harvard business school press.

- De Geus, A. (1997). *The living company*. Boston: Harvard business school press.
- Denzin, N. & Y. Lincoln (2000). Introduction: The discipline and practice of qualitative research. In: *Handbook of qualitative research*. 2nd edition. Ed. Denzin, N. & Y. Lincoln. Thousand oaks etc.: Sage Pulications Inc.
- Drejer, A. (2000). Organisational learning and competence development. *The learning organization* 7:4, 206–220.
- Dyer, L. & J. Ericksen (2005). In pursuit of marketplace agility: applying precepts of self-organizing systems to optimize human resource scalability. *Human resource management* 44:2, 183–188.
- Edvinsson, L. (2002). The new knowledge economies. *Busines strategy review* 13:3, 72–76.
- Engeström, Y. (2007). From stabilization knowledge to possibility knowledge in organizational learning. *Management learning* 38:3, 271–275.
- Firestone, J.M. & M.W. McElroy (2005). Doing knowledge management. *The learning organization* 12:2, 189–212.
- Freiling, J. (2004). A Competence-based theory of the firm. *Management review* 15:1, 27–52.
- Fuchs, C. & W. Hofkirchner (2005). Self-organization, knowledge and responsibility. *Kybernetes* 34:1/2, 241–260.
- Gao, F., M. Li & Y. Nakamori (2002). Systems thinking on knowledge and its management: systems methodology for knowledge management. *Journal of knowledge management* 6:1, 7–17.
- Garavan, T. & D. McGuire (2001). Competencies and workplace learning: some reflections on the rhetoric and reality. *Journal of workplace learning* 13:3/4, 144–163.
- Grant, R. (1996). Toward a knowledge-based theory of the firm. *Strategic management journal* 17, 109–122.

- Gregory, A. (2006). The state we are in: insights from autopoiesis and complexity theory. *Management decision* 44:7, 962–972.
- Gupta, A. & V. Govindarajan (2000). Knowledge flows within multinational corporations. *Strategic management journal* 21:4, 473–496.
- Hall, W. (2005). Biological nature of knowledge in the learning organization. *The learning organization* 12:2, 169–188.
- Hirsjärvi, S., P. Remes & P. Sajavaara (2007). *Tutki ja kirjoita*. 13th edition. Helsinki: Tammi.
- Hong, J. & P. Stähle (2005). *The co-evolution of knowledge and competence management*. Early version of the paper presented at the fifth European conference on organizational knowledge, learning and capabilities, April 2004. Innsbruck.
- Hoyrup, S. & K. Pedersen (2003). The fight over the competencies. In: *Pedagogical sociology. An anthology*. Ed. I.M. Bryderup. Copenhagen: Danmarks pædagogiske universitets forlag.
- Håland, E. & A. Tjora (2006). Between asset and process: developing competence by implementing a learning management system. *Human relations* 59:7, 993–1016.
- Jackson, M. (2000). *Systems approaches to management*. Ney York, etc.: Kluwer academics publishers.
- Jackson, T. (2007). Applying autopoiesis to knowledge management in organizations. *Journal of knowledge management* 11:3, 78–91.
- Juuti, P. & M. Luoma (2009). *Strateginen johtaminen: miten vastata kompleksisen ja postmodernin ajan haasteisiin?* Helsinki: Otava.
- Kakabadse, N., A. Kakabadse & A. Kouzim (2003). Reviewing the knowledge management literature: towards a taxonomy. *Journal of knowledge management* 7:4, 75–91.

- Kast, F. & J. Rosenzweig (1974). *Organization and management: a systems approach*. 2. ed. Japan: McGraw-Hill Kogakusha Ltd.
- Katz, D. & R.L. Kahn (1978). *The social psychology of organizations*. 2. ed. New York, etc.: John Wiley & Sons.
- Kay, R. (2001). Are organizations autopoietic? A call for new debate. *Systems research and behavioral science* 18:6, 461–477.
- Kim, D. (1993). The link between individual and organizational learning. *Sloan management review* 35:1, 37–50.
- Laakso-Manninen, R. & R. Viitala (2007). *Competence management and human resource development: a theoretical framework for understanding the practices of modern Finnish organization*. Helsinki: Edita.
- Leonard-Barton, D. (1992). Core capabilities and core rigidities: a paradox in managing new product development. *Strategic management journal* 13, 111–125.
- Leonard-Barton, D. (1995). *Wellsprings of knowledge: building and sustaining the sources of innovation*. Boston, Massachusetts: Harvard business school press.
- Lippitt, G. (1982). *Organization renewal*. Englewood cliffs, N.J.: Prentice-Hall, Inc.
- Long, C. & M. Vickers-Koch (1995). Using core capabilities to create competitive advantage. *Organizational dynamics* 24:1, 7–22.
- Luhmann, N. (1986). The autopoiesis of social systems. In: *Sociocybernetic paradoxes*. Ed. Geyer, F. & Van der Zouwen, J.. Beverly Hills: Sage.
- Luhmann, N. (1988). The unity of the legal system. In: *Autopoietic law: a new approach to law and society*. Ed. Teubner, G.. Berlin: Walter de Gruyter.
- Luhmann, N. (1990). *Essays on self-reference*. New York: Columbia university press.
- Luisi, P.L. (2002). *Emergence of life: from chemical origins to synthetic biology*. Cambridge, etc.: Cambridge university press.

- Luoma, M. (2006). A play of four arenas: how complexity can serve management development. *Management learning* 37:1, 101-123.
- Löfsted, U. (2001). Competence development and learning organizations: a critical analysis of practical guidelines and methods. *Systems research and behavioral science* 18:2, 115-125.
- Magalhaes, R. (1998). Organizational knowledge and learning. In: *Knowing in firms: understanding, managing and measuring knowledge*. Ed. Von Krogh, G., J. Roos & D. Kleine. London: Sage Publications.
- Maturana, H. & F. Varela (1987). *The tree of knowledge*. Boston/London: Shambhala.
- Maula, M. (1999). *Multinational companies as learning and evolving systems. A multiple-case study of knowledge-intensive service companies. An application of autopoiesis theory*. Doctoral dissertation. HeSE print.
- Maula, M. (2000). The senses and memory of a firm – implications of autopoiesis theory for knowledge management. *Journal of knowledge management* 4:2, 157–161.
- McElroy, M. (2000). Integrating complexity theory, knowledge management and organizational learning. *Journal of knowledge management* 4:3, 195–203.
- Miles, M. & A. Huberman (1984). *Qualitative data analysis: a sourcebook of new methods*. Beverly Hills: Sage Publications.
- Mingers, J. (1997). Multi-paradigm multimethodology. In: *Multimethodology: the theory and practice of combining management science methodologies*. Ed. Mingers, J & A. Gill. Chichester: John Wiley & Sons.
- Morgan, G. (1997). *Images of organization*. Thousand Oaks, California: Sage publications, Inc.
- Nonaka, I. & H. Takeuchi (1995). *The knowledge-creating company*. Oxford university press.

- Nonaka, I. & N. Konno (1998). The concept of “ba”: building a foundation for knowledge creation. *California management review* 40:3, 40–54.
- Nonaka, I., R. Toyama, R. & N. Konno (2000). SECI, Ba and leadership: a unified model of dynamic knowledge creation. *Long range planning* 33, 5–34.
- Nonaka, I. & G. Von Krogh (2009). Tacit knowledge and knowledge conversion: controversy and advancement in organizational knowledge creation theory. *Organization science* 20:3, 635–652.
- Nordhaug, O. & K. Gronhaug (1994). Competences as resources in firms. *The international journal of human resource management* 5:1, 89–106.
- Parboteeah, P. & T. Jackson (2007). An autopoietic framework for organizational learning. *Knowledge and process management* 14:4, 248–259.
- Paucar-Caceres, A. & R. Pagano (2009). Systems thinking and the use of systemic methodologies in knowledge management. *Systems research and behavioral science* 26, 343–355.
- Penrose, E. (1966). *The theory of the growth of the firm*. 3. ed. Oxford: Basil Blackwell.
- Prahalad, C.K. & G. Hamel (1990). The core competence of the corporation. *Harvard business review*. May–June 1990, 79–91.
- Quinn, J.B., P. Anderson & S. Finkelstein (1996). How can an organization’s capabilities exceed the sum of its parts? Managing professional intellect: making the most of the best. *Harvard business review* 74:2, 71–80.
- Sahavirta, H. (2006). *Karl Popper’s philosophy of science – and the evolution of the Popperian worlds*. Doctoral dissertation. Helsinki: yliopistopaino.
- Sanchez, R. (1997). Managing articulated knowledge in competence-based competition. In: *Strategic learning and knowledge management*. Ed. Sanchez, R. & A. Heene. Chichester: John Wiley & Sons.

- Sanchez, R. (2001). Managing knowledge into competence: the five learning cycles of the competent organization. In: *Knowledge management and organizational competence*. Ed. Sanchez, R.. New York, Oxford.
- Sanchez, R. (2004). Understanding competence-based management Identifying and managing five modes of competence. *Journal of business research* 57: 518–532.
- Sanchez, R. & A. Heene (1996). Competence-based strategic management: concepts and issues for theory, research and practice. In: *Competence-based strategic management*. Ed. Heene, A. & R. Sanchez. Chichester: Wiley.
- Sanchez, R. & A. Heene (2004). *The new strategic management: organization, competition and competence*. New York: Wiley.
- Sandberg, J. (2000). Understanding human competence at work: an interpretative approach. *Academy of management journal* 43:1, 9–17.
- Sandberg, J. (2005). How do we justify knowledge produced within interpretive approaches? *Organizational research methods* 8, 41–68.
- Senge, P. (1996). *The fifth discipline: the art and practice of the learning organization*. New York: Doubleday currency.
- Skyttner, L. (1996). General systems theory: origin and hallmarks. *Kybernetes* 25:6, 16–22.
- Spanos, Y. & G. Prastacos (2004). Understanding organizational capabilities: towards a conceptual framework. *Journal of knowledge management* 8:4, 31–43.
- Stacey, R. (2001). *Complex responsive processes in organizations: learning and knowledge creation*. London/New York: Routledge.
- Stacey, R. (2007). *Strategic management and organizational dynamics: the challenge of complexity*. 5th edition. Harlow, England, etc.: Prentice Hall.
- Stacey, R., D. Griffin & P. Shaw (2000). *Complexity: fad or radical challenge*. London/New York: Routledge.

- Stalk, G., P. Evans & L. Shulman (1992). Competing on capabilities: The new rules of corporate strategy. *Harvard business review* 70:2, 57–69.
- Ståhle (1998). *Supporting a system's capacity for self-renewal*. Doctoral dissertation. Helsinki: Yliopistopaino.
- Ståhle, P. & M. Grönroos (1999). *Knowledge management*. Porvoo: WSOY-kirjapainoyksikkö.
- Ståhle, P. & M. Grönroos (2000). *Dynamic intellectual capital – knowledge management in theory and practice*. Porvoo, etc.: WSOY.
- Ståhle, P., S. Ståhle & A. Pöyhönen (2003). *Analyzing dynamic intellectual capital: system-based theory and application*. Lappeenranta university of technology. Acta Universitatis lappeenrantaensis 152.
- Sundber, L. (2001). A holistic approach to competence development. *Systems research and behavioral science* 18:2, 103-114.
- Sveiby, K.E. (1997). *The new organizational wealth: managing & measuring knowledge-based assets*. San Francisco: Berrett-Koehler.
- Sveiby, K.E. (2001). A Knowledge-based theory of the firm to guide in strategy formulation. *Journal of intellectual capital* 2:4, 344–358.
- Teece, D., G. Pisano & A. Shuen (1997). Dynamic capabilities and strategic management. *Strategic management journal* 18:7, 509–533.
- Tsoukas, H. & N. Mylonopoulos (2004). Introduction: what does it mean to view organizations as knowledge systems. In: *Organizations as knowledge systems: knowledge, learning and dynamic capabilities*, 1–28. Ed. Tsoukas, H. & N. Mylonopoulos. Hampshire: Palgrave Macmillan.
- Tuomi, J. & Sarajärvi, A. (2002). *Laadullinen tutkimus ja sisällönanalyysi*. Helsinki: Tammi.

- Varela, F. (1981). Autonomy and autopoiesis . In: *Self-organizing systems: an interdisciplinary approach*, 14-23. Ed. Roth, G. & H. Schwegler. Germany.
- Varela, F. (1984). Two principles of self-organization. In: *Self-organization and management of social system*. Eds. Ulrich, H. & G. Probst. New York: Springer Verlag.
- Varela, F., E. Thompson & E. Rosch (1991). *The embodied mind: cognitive science and human experience*. USA: MIT.
- Venzin, M., G. Von Krogh, & J. Roos. (1998). Future research into knowledge management. In: *Knowing in firms: understanding, managing and measuring knowledge*. Ed. Von Krogh, G., J. Roos & D. Kleine. London: Sage Publications.
- Viitala, R. (2005). *Johda osaamista!*. Keuruu: Otavan Kirjapaino Oy.
- Von Krogh, G. (2009). Individualist and collectivist perspectives on knowledge in organizations: implications for information systems research. *Journal of strategic information systems* 18, 119–129.
- Von Krogh, G. & J. Roos (1995). *Organizational epistemology*. New York: St. Martins Press, inc.
- Von Krogh, G. & J. Roos (1995b). A perspective on knowledge, competence and strategy. *Personnel review* 24:3, 56–76.
- Von Krogh, G., J. Roos & K. Slocum (1994). An essay on corporate epistemology. *Strategic management journal*. 15: 53–71.
- Von Krogh, G., J. Roos & K. Slocum (1996). An essay on corporate epistemology. In: *Managing knowledge: perspectives on cooperation and competition*. Ed. Von Krogh, G. & J. Roos. London, etc: Sage.
- Zack, M. (1999). Managing codified knowledge. *Sloan management review* 40:4, 45–58.