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Views and practices on inter-organizational learning in innovation networks

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Abstract — In this paper, the aim is to study inter-organizational learning in innovation networks. We will particularly concentrate on different currently important or increasingly important approaches and views on organizational learning which are particularly relevant from the standpoint of networked innovation. The approaches can also be considered to be rather fundamental and general perspectives that lie behind many other learning perspectives. We aim to analyze the different learning approaches and evaluate their suitability in various situations and conditions of innovation networks in particular. We also suggest some practices in the case of each learning approach.

Keywords — Learning, inter-organizational learning, innovation, network

I. INTRODUCTION

In recent years, effective learning and knowledge generation have been acknowledged to have an important effect on successful innovations and innovative processes in organizations.

Since the research and development activities of organizations are increasingly organized in networks of several participants from outside the organization, innovations in product or service development are born especially in the boundaries that combine different areas of expertise and operations [1]. These networks typically consist of parts of several separate organizations working together but in distributed locations. They need to be in constant contact with each other to be able to coordinate the innovation activities.

This form of organizing in networks is challenging for the participants on both organizational and individual level for many reasons, particularly from knowledge creation and sharing point of view. The knowledge creation, information gathering and sharing activities within innovation networks have a great importance, since they help the organizations to learn about and from each others. The organization's learning capabilities also have crucial importance in generating innovations [2]. Learning enables the organizations for example to renew themselves, and to keep up with competition. Furthermore, learning faster and more effectively than the competitors may be the only source of

sustainable competitive advantage in competitive markets [3].

As the amount of actors in a network grows and the changes in the environment become faster, the complexity of the innovation process increases significantly. This, in turn, increases the need for effective learning. For example in industries which have been described as highly information intensive and where changes in the operating environment are fast, the ability to learn effectively in a network can be very important.

The theories of organizational learning are in this study extended to particularly discuss organizational learning in a wider setting, between several organizations and organizational networks or partnerships. The applicability of organizational learning to the inter-organizational level is a starting point for this study, although in the inter-organizational and network environment the learning process may be significantly more complex to be managed.

Inter-organizational learning and learning in networks can be seen as complementary views, so that generally, inter-organizational learning can mean learning that takes place between any two organizations, e.g. also competitors, and learning in networks takes place between several participants operating in a more or less formal partnership. Another feature in learning is that it is either based on one partner learning from the other(s), or the partners create something new together and learn something that is new for all of them. Learning together in a reciprocal learning alliance is said to be more effective and faster than learning alone, enabling also faster results [1].

In this paper, the aim is to study inter-organizational learning in innovation networks. We will particularly concentrate on different currently important or increasingly important approaches and views on organizational learning which are particularly relevant from the standpoint of networked innovation. The approaches can also be considered to be rather fundamental and general perspectives that lie behind many other learning perspectives. We aim to analyze the different learning approaches and evaluate their suitability in various situations and conditions of innovation networks in particular.

First, to have an overview of learning in networks, the paper presents several fundamental learning types, based on division between behavioral and cognitive learning. In the

next chapter, selected important approaches of organizational learning from the network perspective are introduced and evaluated according to their emphasis on the behavioral and cognitive components of learning as well as in respect to their similarities and differences. The suitability of each theoretical approach for various situations or conditions in inter-organizational innovation networks is discussed, and some preliminary ideas on practices to support effective learning in innovation networks are proposed.

The results of the paper contribute both to academic community and practical innovation management, since the subject has not been studied very exhaustively and the present literature is rather scattered and ambiguous despite recent growing interest in organizational learning and innovation processes.

II. TYPES OF ORGANIZATIONAL LEARNING

Organizational learning and various organizational learning approaches can be thought to consist of and be based on some basic or fundamental concepts and types of learning. Such concepts are briefly introduced in this chapter.

A. Behavioral and cognitive learning

In pedagogical literature mainly concerning learning on an individual level, learning theories have traditionally been divided into two different categories, depending on how learning is seen to take place. According to behaviorist view, learning requires an observable change in behavior. In the cognitivist view, however, an explicit change in behavior is not necessary for learning to have occurred. The cognitivists state that a change on the cognitive level, potentially leading to a change in behavior, is enough for learning to have occurred. A change in behavior can also be a result of something else than learning, i.e. mere adaptation to the situation without any lasting impact. The corresponding theoretical views are named behavioral theories of learning and cognitive theories of learning.

As a result, on an organizational level there are also rather diverse views on the topic of when an organization learns. One rather common perspective in literature is that organizations learn when their knowledge in the form of rules and standard operating procedures are changed [4], see also [5], i.e. their actual behavior changes. From another perspective, information processing perspective, an organization or another entity learns "if, through its processing of information, the range of its potential behaviors is changed" [6]. Drawing from this, Sinkula [7] does not view overt change as a necessary condition for learning to have occurred, nor does he view actual decision making as a necessary condition for learning.

B. Single loop and double loop learning

Several models on organizational learning have been presented in the literature [8],[9], [10],[11]. One of the most well-known is developed by Argyris and Schön [8]. This basic model of organizational learning describes two

levels of learning, the single loop and the double loop level. The basic premise here is that organizations learn and make decisions and adjustments often through the mechanism of feedback [4]. Argyris [12] states that whenever an error is detected or corrected without questioning or altering the values of the system, it is defined as single loop learning. Double loop learning occurs when the mismatch in the system is corrected by first examining and altering the governing variables of the system, designating changes in organizational processes and structures, while according to McKee [13], double loop learning is based on questioning the existing structures, norms and values. According to Argyris [12] both types of learning are needed in organizations. He concludes that where single loop learning is mostly addressed to the simple and operative actions, double loop activities are related to the complex and strategic organizational processes, which often control the effectiveness of the system.

The needed type of learning needs to be considered in innovation context, since different kind of objectives in the development work lead to different kinds of requirements for learning. The needed type of learning always depends on the situation, since new and radical innovations are possible with double loop learning that challenges the mental models of the actors, whereas sometimes single loop learning might be enough. So the optimal level of learning has to be defined for each situation in order to learn effectively.

It is important that an organization is able to utilize both types of learning and define the appropriate level of learning, depending on the situation. It can be said that in creating innovations, the single loop, corrective learning is sufficient for incremental improvements, but to achieve radical innovations, the organization must also have the ability for double loop level learning [13]. Adjusting this idea to include a partner relationship or to larger networks of several participants, this means that the network as a whole needs to have the ability to utilize both levels of learning. In other words, they should be able to correct their actions based on experiences, but also be able to question the foundations of the common beliefs and norms. This requires, that a common understanding and interpretation of the basic operating rules exists between the partners.

C. Framework for organizational learning types

Nemeth [14] presents a framework for different types of organizational learning, originally developed by Crossan in 1991 [11]. In this framework, cognitive change and behavioral change are combined as different axis of a quadrangle, and depending on the type of learning, cognitive and / or behavioral changes take place. The framework is illustrated in Figure 1 and explained in more detail according to Nemeth [14] in the following.

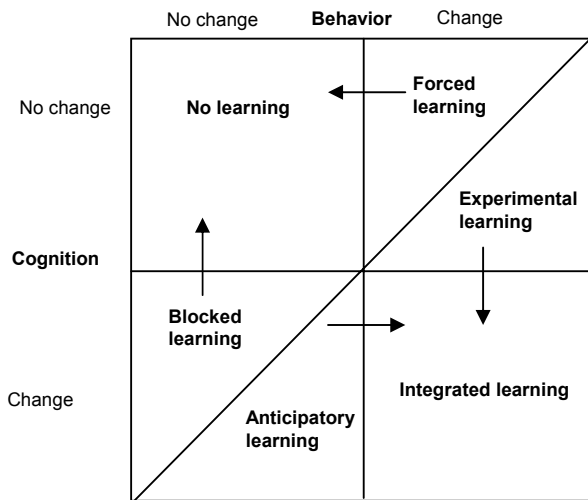


Figure 1. Types of organizational learning according to cognitive and behavioral change. [14], original model presented by Crossan [11].

When both cognitive change and behavioral change are missing, the framework suggests that no learning has occurred at all. On the contrary, when both cognitive and behavioral changes happen, this is seen as integrated learning. There are also different degrees of cognitive and behavioral change pictured in the other quadrants of the Figure 1, as well as differences in the durability of the changes that are the result of learning. Integrated learning can be seen as the most desirable, because its effects are relatively permanent.

Forced learning, in the top right section, occurs when there is a change in behavior but no cognitive change. The learner has been forced to change but does not change its own cognitive models. In experimental learning, the learner suspends its beliefs to try a new behavior. If the experience with the new behavior is positive, experimental learning can develop into integrated learning where the change in behavior also leads to a rather permanent change in cognition.

Blocked learning, in the lower left section involves cognitive changes that do not lead to behavior changes, because some conditions exist in the organization, that prohibit the change in behavioral level. Blocked Learning cannot be observed from outside, and may not even be conscious. Anticipatory learning, in contrast, has changed the learner's cognition and may result in a change in behavior or actions later, and therefore change into integrated learning. This means that the organization has some internalized knowledge that it recognizes as potentially useful.

Integrated learning, as described above, is learning that combines both cognitive and behavioral change. To achieve sustainable changes as a result of learning, there is a need for a balance between both cognitive and behavioral components of learning.

The importance of this framework is based on the knowledge that different types of learning exist that combine the elements of behaviorism and cognitivism, and that they can be used to achieve different types of

organizational goals. Integrated learning is seen as the predominant type for lasting effects and thus might be desirable, but there are conditions in which forced learning or anticipatory learning might work best in an organization and be more suitable to achieve the wanted results.

When considering innovation activities in networks of organizations, it becomes important to recognize the need for different types of learning as well, and which type of learning would be most suitable for the situation of the innovation network.

III. VIEWS OF INTER-ORGANIZATIONAL LEARNING

In the following, several different theoretical views on organizational learning that are seen as important from inter-organizational perspective will be presented. Finally, the theoretical views are combined with the previous framework of different types of learning, and the implications to efficient learning in networked innovation will be discussed.

A. Organizational learning theories and approaches from inter-organizational perspective

All of the selected different views on inter-organizational learning presented in this paper (see Table 1 in the Appendix) are often highlighted in the literature related to organizational learning, or specifically learning in networks. They have been referred to by many different authors and have gained attention in the areas of innovation and networks. They can be regarded as currently important or rising theories or viewpoints on learning, they all have a significant amount of empirical research behind them that has proved them to be valid in the scientific perspective, they can be considered to be rather fundamental and general perspectives that lie behind many other learning perspectives, and they have been published in various important academic journals. Also we are deliberately including in this study different types of views to highlight the differences that they have and to have possible implications from a broad spectrum of views.

Conversion of explicit and tacit knowledge [10], [5] is based on the idea that the key to knowledge creation is in the mobilization of organizational tacit knowledge, and to enable this there is a need for conversion between tacit and explicit knowledge types in the knowledge creation processes. Knowledge creation processes between explicit and tacit knowledge are needed also between organizations, and should be designed from the beginning of a network.

Exploitative and explorative learning [15], [16] says that organizational learning occurs primarily via organizational routines (i.e. actions, procedures, norms, and models). According to Levinthal and March [15] organizational learning should aim to cope with the problem of balancing the competing goals of exploration, i.e. the development of new knowledge, and exploitation, i.e. exploiting current information, knowledge and organizational competencies. Much of this knowledge is embedded in the different organizational routines and procedures. Between

organizations and in networks, it should be noted that the importance of exploitation and exploration varies dynamically and dialectically in the different stages of the network relationship.

Absorptive capacity, relative absorptive capacity [17], [18], [19] This view is based on the similarity of previous knowledge to the new knowledge. Previous knowledge enhances the learning of similar knowledge, and learning is most effective when the new knowledge to be assimilated is related to the existing knowledge. In a network, the greatest potential for learning comes from learning from teachers with similar basic knowledge but different specialized knowledge. Routines can be made more effective by enhancing partner-specific (ability to absorb knowledge from specific partner) or relative absorptive capacity.

Organizational memory [20], [21], [22] Organizations are assumed to create, use and store information and knowledge in a similar way as individuals do. Learning occurs via doing and experiencing, and is stored in organizational work and core processes, as well as products, services or other constructed artefacts. Thus, between organizations, the creation of inter-organizational routines (formal or informal, e.g. social or business), and creation of formal and informal networks as well as common databases and other forms of storing knowledge is important.

Systems thinking [9], [23], [4] Interactions and interdependencies are an important focus of interest in this approach to learning, and feedback is an essential prerequisite for effective learning. Capability of systems thinking enhances the capability for double loop learning. Senge [9] defines the learning organization as an organization that is continually expanding its capacity to create its future. The capability to innovate and being innovative, as well as learning from the future can be therefore seen as a fundamental element of learning organization. It is important to recognize the whole structure of an organizational system and also to identify virtuous and vicious loops. In a network, the partners should have a common and in-depth understanding of their mutual interdependencies and the larger system they are part of. Continuous, regular feedback and approaches that support the utilization of feedback are important.

Dynamic capabilities [24], [19] This approach is based on the ideas of the resource-based view of the firm and complementary assets, and the continuous ability to renew and adapt competencies dynamically according to the changing situation through learning. From a network point of view, an organization's critical resources that are rare, valuable, complementary and hard to imitate may extend beyond firm boundaries. In this view, partnerships enable inter-firm learning by helping to recognize dysfunctional routines and develop them.

B. Organizational learning views in the cognitive / behavioral framework

In the following Figure 2 we have located all of the above mentioned views on organizational learning in the cognitive / behavioral framework presented in the previous

chapter, according to the authors' perspective on how the two components are shown in each view. This is done to reflect the fundamental orientation of each theory or view, according to whether they implicitly or explicitly emphasize the change in behavior or cognitive level. There are of course many ways to classify the presented views and so the locations of the views in the figure are not exact but give an idea on the type and emphasis of learning they most likely resemble. Part of the views can be classified under multiple types of learning, and the important fact is that organizations should be able to combine and utilize several of the learning views simultaneously. The reasons for locating each view in the framework are described in the following.

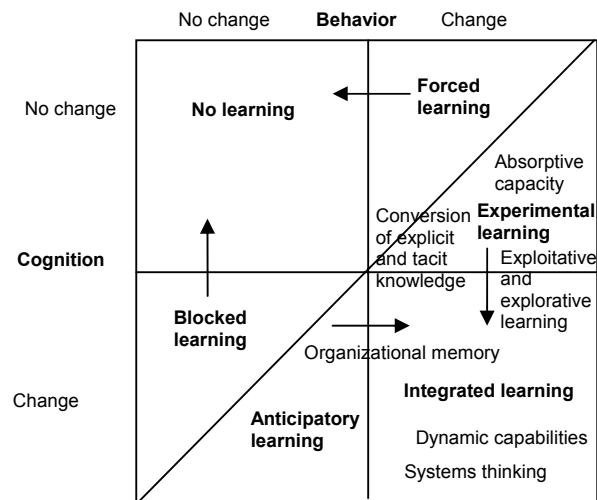


Figure 2. Location of selected views on organizational learning within the cognitive / behavioral framework.

Starting from the top right corner of the quadrangle, where changes occur mainly in behavior but not so much in cognition, single loop learning described by Argyris & Schön [8], can be seen as forced or experimental learning, since it is based on changing behavior without a change in the existing mental models (cognition).

Conversion of explicit and tacit knowledge [10] can be classified into any of the learning types that change the behavior of the learner or the learning organization(s), depending on which stage of the conversion process is active. Thus, this view can be classified as forced, experimental or integrated learning.

Absorptive capacity and relative absorptive capacity view [17], [18], [19] changes in the first stage the behavior of the organizations, and if the experience is positive then also cognitive changes can happen. This is natural for experimental learning.

Also exploitative and explorative learning [15],[16] can be seen similar to this, although it might more easily turn into integrated learning, so it is pictured nearer to this category.

Moving to the lower right corner of the quadrangle, where both types of changes are possible, double loop learning, as seen by various writers [8], [9] changes both

the cognitive framework and the behavior of the entity in question, so it is easy to see as part of integrated learning type. However, it can also be seen as anticipatory learning, since the changes in behavior might come later than the change in cognition, meaning that it takes time to act on the change.

Organizational memory view [20], [21], [22] is similar to double loop learning in the sense that creating a common organizational memory form also the cognitive capacity is changed, and this enables changes in behavior, either in the same time or at a later time. In any case, the organization has created some valuable and useful knowledge it might utilize.

The dynamic capabilities view [23], [19] is in this model located as an integrated type of learning, because it requires on-going evaluation of the cognitive, mainly knowledge based resources of the organization, and also immediate changes in the behavior of the organizations according to the results of the evaluation.

Systems thinking view can be located as integrated learning, since it is a holistic approach to organizational learning which changes both the cognitive and the behavioral level [9]. Senge [9] emphasizes seeing and changing the structures (mental models, cognitive level) behind the actions (behavioral level) and Sterman [24] sees feedback as a requirement for learning to take place.

C. Features of inter-organizational learning

As a synthesis from the presented views on learning, we have identified some fundamental features that can be found from several of the above described learning views. It seems that the similarities and differences of the selected views on learning in organizations and between organizations can be described at least with regard to following factors, and these issues should be answered when designing the learning approach in organizations.

Feedback process. Feedback is seen as a requirement for learning in many different approaches, but in some views it is left without attention, so it is not seen a critical requirement. However, in an organizational setting and especially between organizations, it is an important factor to take into account.

Routines. The results of learning can be stored in the behavioral routines of the organization or network. The routines developed can also be seen as an outcome of the learning process, not only as a feature of the process.

Mental models and assumptions. In some views, the existing mental models and underlying assumptions are changed as a result of learning, or in some models they are left unchanged. The situation of the organization defines how much it should possess the ability to question the existing structures.

Knowledge integration. There are similarities and differences between different views on how they see the method of knowledge integration, how knowledge is integrated from individual to organizational and finally inter-organizational level.

Coordination. How is the knowledge acquired by learning being coordinated, in order to allow efficient use

by different members of the organization? Here the basic choices are either centralized or distributed coordination. The same applies in the case of networks of organizations, and is often complicated by the matter of knowledge ownership between the partners.

Knowledge on "Who knows what?". Since the expertise and mainly tacit knowledge is distributed in the organization, between persons working there, the meta-knowledge on who possesses which kind of information is valuable and helps in utilizing the knowledge. In networks of organizations, this knowledge has to be somehow managed and transferred between the organizations and between individuals working in the separate organizations.

IV. INTER-ORGANIZATIONAL LEARNING IN INNOVATION NETWORKS

A. Suitability of the selected learning views in different situations

We cannot directly recommend any single approach to be used in specifically certain types of situations, industries or other contexts in innovation. However, each studied approach covers some important aspects of learning, and the different views and theories emphasize rather different types of approaches that should be drawn attention to and focused on when organizations and networks aim to develop their learning abilities in innovation. No single standpoint or approach alone can provide a basis for effective learning in the case of any individual organizational network or any individual situation.

Effective learning with sustainable, long-term impact on organizational competitive advantage can be achieved most likely when various aspects and standpoints of learning are simultaneously taken into consideration when planning inter-organizational network cooperation. However, we have more carefully analyzed when certain approaches of learning should be emphasized in the facilitation of learning in networked innovation.

Roughly speaking, the conditions affecting the learning approach emphasis can be divided into two categories:

- network-specific factors (internal for the organizational network; factors that the network and the individual network participants more directly have influence on)
- factors concerning the business environment of the organizational network (external for the network; factors that network has no influence on, or can influence only / mainly indirectly)

In this chapter, we have evaluated the described learning approaches and their interrelationships with factors internal and external for the network.

Conversion of explicit and tacit knowledge. Since this (or 'Nonakan') approach emphasizes the mobilization of tacit knowledge, its use should be emphasized particularly when a network operates in a field or an industry in which a significant amount of existing knowledge is tacit-based, or in which tacit knowledge has a particularly large importance for the business. Such cases include knowledge-intensive industries like ICT and biotechnology.

For another thing, industries which experience significant effects due to generation-change (such as the Finnish forest industry), or are in a fear of losing critically important and rare tacit knowledge for instance in the form of rare experts or other specialist due to e.g. pensioning or the result of head-hunting, should focus on Nonakan types of learning approaches. Such cases include e.g. hi-tech SMEs with narrow specialization and few centrally important experts. Furthermore, networks that for certain reasons involve significant barriers for transferring tacit knowledge, such as international multi-cultural business networks (see e.g. [25]), or virtual or “imaginary” organizations [5], and other networks which involve participants with large cultural and/or cognitive distance like organizations with clear focus on utilization of virtual teams [26] from different organization-cultural or other cultural backgrounds should focus on this approach.

Exploitative / explorative learning. According to Gilsing and Nooteboom [27], exploitation implies the focus on incremental innovations and codified knowledge, as well as rather formal, stable and delocalized networks, while exploration usually implies more focus on radical innovations and tacit knowledge, together with informal, unstable / dynamic and relatively locally embedded networks. The above focus areas should also be strongly reflected in the way that organizational and inter-organizational learning activities are carried out: for instance, exploitation requires relatively low frequency of interaction, contract or institution-based trust and single loop learning, while exploration relies more on higher levels of interaction, personal or relation-based trust and double loop learning [27]. The balance between exploitative learning and explorative learning and the related learning-oriented activities should be continuously re-evaluated, as the exploitation and exploration are dialectical and dynamic processes. In particular, the re-evaluation should be carried out regularly when the networked operations or the network maturity, or the business and the markets of the network, or the products of the network develop rapidly. According to Nooteboom [16], in networks of exploration the future uncertainty of structural change should be taken into account, this requiring the innovation of new business concepts, products, and services [28]. In networks emphasizing exploitation of present knowledge, the benefits of more static efficiency are sought after.

Absorptive capacity (AC). The AC-based or relative AC-based learning, and the commonality of potential partners, should be given particular note for when companies or networks are planning on outsourcing some of their R&D-related activities or competencies (e.g. when globalizing their activities and R&D), and e.g. when an organizational network or its individual participants are in need to look for new ways of co-operation or suitable new close partners either from inside or outside the network. In such outsourcing situations, there is also a risk of outsourcing a part of a firm’s and networks learning capability (i.e. absorptive capacity). In addition, according to Lane and

Lubatkin [18], relative AC may be useful also in leveraging a firm’s core competences across its business units especially in complex, transnational corporations (see [17], [18]).

Organizational memory. Generally speaking, the development of various forms of organizational and common inter-organizational memory forms is important in all network forms that really aim to adopt a networked way of operation in innovation. However, e.g. according to Koistinen [22], when the complexity of commonly developed products or the business setting increases significantly, there is a need to emphasize particularly the development of business and social routines as the specific forms of organizational memory. On the other hand, for instance when the roles and the core competencies are not carefully determined and understood collectively, or they are very challenging to be defined explicitly considering the overall goals of the whole network, the organizational memory form called transactive memory (who knows what in the network) should be carefully emphasized in the development of the network. An example of a networking form in which the role of transactive memory is further emphasized is “the communities of practice” [29].

Systems thinking. Systems thinking approach is particularly relevant when the organizational network is complex, it includes various and complex interrelationships between network actors, or the boundaries of subsystems within the network or larger systems outside the network are not well defined and understood by the network participants. The recognition and definition of virtuous loops should be given attention to when the competition is hard, and when there is a significant need to support the recognition and creation of various sources for sustainable competitive advantage, and the recognition of vicious loops for instance when innovative activities and product development are jeopardized by continuous fire-fighting and emphasis on short-term instead of long-term planning, for instance in networks characterized by complex multi-project environments [30]. In addition, systems thinking approaches should be noted for when the network has a need to shorten development time by moving into more parallel type of innovation processes and followingly, when the related product and process architectures should be modularized in order to minimize the inter-dependencies and communication needs during innovation projects, for instance when the participants in networked innovation activities are located in geographically distant places or different countries. Double loop learning should be emphasized instead of mere single loop learning particularly when there is a clear need for more radical innovations [13] in the network firms, for instance in the case of very novel industries / markets, or very mature industries which feel the need for growth by new types of innovations.

Dynamic capabilities. This approach to learning should be emphasized particularly when the networks face markets, competition and business environments that are relatively highly turbulent, weakly predictable, and fast-

changing [23], such as in the electronics and ICT industries. Also when the capabilities and resources of the network are not easily coordinatable, for instance when it is not easy to define the core competences of individual network participants for efficient definition of the expertise-based roles of the network, this approach should be specially given attention to.

B. Practices for supporting inter-organizational learning in innovation

In the following, we have collected some examples of general practices or actions in organizations and networks that can be seen as important and that are typical for each of the selected organizational learning views, especially applied to inter-organizational learning and innovation (see also Table 1 in the Appendix). These practices can be used for supporting effective inter-organizational learning in innovation activities.

Conversion of explicit and tacit knowledge highlights the importance of mobilization of tacit knowledge and building the processes for knowledge creation. This means that the participants in the network need to be able to identify the important tacit knowledge from the network point of view, and to create both formal and informal processes to enable the flow of information. Formal processes can be meeting procedures, documents or instructions, or for example documented objectives for learning. Informal processes give the possibility to share knowledge in an informal setting, for example events that only focus on people getting to know each other, and these can even be organized by the employees themselves.

Exploitative and explorative learning assumes that the routines needed for learning change with time, and the suitable balance between exploration and exploitation needs to be evaluated in different stages of the network development. Learning also requires commitment between the partners, to keep the relationship alive.

Absorptive capacity view implies that the similarity of the knowledge base plays an important role in learning between partners, so the identification of own basic and specialized knowledge gives a starting point to evaluate similarities between partners. Also future goals and plans should be considered, and maybe modified to find possible common goals in the network.

Organizational memory view sets the creation of a common memory for the network in different forms such as routines and databases as a goal, and thus every member of the network should be able to identify and describe its current processes and routines. As part of the organizational memory, also the knowledge on who possesses certain kind of knowledge (transactive memory) is important. In a network, developing new processes and routines is important, not only copying existing processes.

Systems thinking approach emphasizes seeing the bigger structures, and in this case it means the ability to describe the network and the role of each participant as well as interdependencies between partners. The aim is to establish a shared understanding of the network to allow efficient learning, and also establish feedback processes in different

stages of the innovation process. The identification of virtuous and vicious loops can also be utilized. In innovation activities, it is possible to design the product, service and process architecture together with other network partners to minimize interdependencies and communication needs during innovation projects, for instance when the participants in networked innovation activities are located in geographically distant places or different countries

Dynamic capabilities view requires that the critical and valuable resources in the network are identified, also from the network point of view, and re-evaluated regularly to enable necessary changes. Learning is based on improving and developing routines and this can also be done together with the partners.

V. CONCLUSIONS

Organizations' ability to learn faster and better has become an essential element of competitive advantage. The increasing interconnectedness and complexity of the business environment requires effective learning, both within and between organizations.

In the pursuit of a competitive advantage, learning in the context of innovation and innovation-related networks is a particularly challenging but increasingly more important task for companies. Efforts put into the development of inter-organizational networks that support effective learning in innovation can provide as much as a basis for a relatively sustained competitive advantage for companies. In the extant literature, we have found very few articles on the subject of learning in inter-organizational networks.

In this paper we have studied organizational learning from the standpoint of inter-organizational networks and innovation in particular. Instead of exploiting just one standpoint on the topic, we have studied this subject from the standpoint of rather diverse views and theories.

In the literature, there are diverse views on the concepts of learning and organizational learning. We selected and described different currently important or risingly important approaches and views on organizational learning which are particularly relevant from the standpoint of networked innovation, as well as having a significant amount of empirical research behind them that has proved them to be valid in the scientific perspective. The approaches can also be considered to be rather fundamental and general perspectives that lie behind many other learning perspectives.

We then analyzed the different learning approaches and views a) concerning their fundamental learning orientation in respect to cognitive and behavioral learning with the help of an analytical and illustrative framework by Crossan [11], and b) concerning their suitability in various situations and conditions of innovation networks in particular. Concerning the managerial perspective, we also suggest rather pragmatic guidelines to be considered in each type of studied learning approach (see also Table 1 in the Appendix).

Since innovation is a particularly challenging and

important task or process from the standpoint of knowledge creation and innovation, several standpoints should be recognized and used when aiming at effective learning. Attention should be focused on the effective facilitation of learning particularly in information and knowledge intensive industries, the competitiveness and future of which depend on their ability to learn and to renew themselves.

On the basis of this study, it seems that effective learning with sustainable, long-term impact on organizational competitive advantage can be achieved most likely when various aspects and standpoints of learning are simultaneously taken into consideration when planning interorganizational network cooperation.

Even though we cannot directly recommend any single approach to be exclusively used in any certain types of situations, industries or other contexts in innovation, we found clearly that several network-specific internal and external factors affect the suitability and emphasis of selected inter-organizational learning approaches. Each studied learning approach seemed to cover some important aspects of learning, and the different views and approaches emphasize rather different types of organizational learning that should be drawn attention to and focused on when organizations and networks aim to develop their learning abilities in innovation.

From the standpoint of effective knowledge creation, accumulation and learning in innovation networks, it is important for managers to clarify network-specific and external factors that affect the choices of suitable learning approaches and their mutual emphases, and attempt to build, accordingly, suitable learning practices into their organizations.

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APPENDIX / TABLE 1

DIFFERENT VIEWPOINTS ON INTER-ORGANIZATIONAL LEARNING AND THEIR IMPLICATIONS AND SUPPORTING PRACTICES IN NETWORKED INNOVATION (modified from [28]).

<i>View / perspective</i> (Authors)	<i>Implications for inter-organizational learning:</i>	<i>Implications for networked innovation from the standpoint of effective learning:</i>	<i>Examples of typical/specialized practices to support inter-organizational learning in innovation</i>
<i>Conversion of explicit and tacit knowledge</i> (Nonaka & Takeuchi, Holmqvist)	Knowledge creation processes between explicit and tacit knowledge are needed also between organizations.	Knowledge creation processes should be built-in explicitly in both formal and informal innovation processes.	<ul style="list-style-type: none"> - Identification and mobilization of important tacit knowledge for the network - Formal processes: meetings, written documents and instructions, objectives for learning - Informal processes: possibility to share knowledge in informal setting, employee-organized activities
<i>Exploitative and explorative learning</i> (Levinthal & March, Nootboom)	Balance between exploitation and exploration varies in the different stages of the network relationship.	The importance of routines for exploration increases as a source of innovation.	<ul style="list-style-type: none"> - Identify and evaluate the needed balance between explorative and exploitative routines in different stages of the relationship, first need for more explorative and then exploitative learning - Learning requires commitment, keeping the relationships alive on personal and organizational level
<i>Absorptive capacity, relative absorptive capacity</i> (Cohen & Levinthal Lane & Lubatkin Dyer & Singh)	Greatest potential comes from learning from teachers with similar basic knowledge but different specialized knowledge. Routines can be made more effective by enhancing partner-specific absorptive capacity (ability to absorb knowledge from specific partner).	Partners should possess similar type of knowledge bases, similar organizational structures and compensation policies, similar knowledge-processing style, as well as similarity in the companies' commercial objectives.	<ul style="list-style-type: none"> - Identification of basic and specialized knowledge by taking stock of the existing knowledge base => possibility to evaluate similarity - Talk about objectives and future plans with the innovation partners; find possible common present and future goals for network participants - Identification of one or more suitable participants as possible teacher
<i>Organizational memory/</i> (Walsh & Ungson, Moorman & Miner, Koistinen)	Creation of interorganizational routines, and creation of formal and informal networks as well as databases etc.	Creation of common, commonly understood innovation processes and routines, as well as the creation of other important memory forms.	<ul style="list-style-type: none"> - Creation of common organizational memory for the network as a goal - Model and describe current processes and routines of individual organizations, as well as formal databases - Transactive memory: important to learn efficiently who knows what. Centralized / distributed control. - Instead of copying processes from others, try to create new processes together
<i>Systems thinking</i> (Senge, Sterman, Argyris)	Common and in-depth understanding of their mutual interdependencies and the larger system they are part of. Continuous, regular feedback and approaches that support the utilization of feedback are important.	Enables questioning the existing mental models as well as creating radical innovations. Identifying the virtuous or vicious loops in innovation processes and taking advantage of the loops in questioning the present thinking as well as in creating new ways to innovate.	<ul style="list-style-type: none"> - Describe the network and its objectives together to establish a shared view of each participant's role in the network - Recognition and description of interdependencies of network participants - Establish feedback processes in different stages of the innovation process - Design the product, service and process architecture together with other network partners to minimize interdependencies and communication needs during innovation projects, for instance when the participants in networked innovation activities are located in geographically distant places or different countries - Identification of virtuous / vicious loops
<i>Dynamic capabilities/</i> (Teece & Pisano & Shuen, Dyer & Singh)	Firm's critical resources (rare, valuable, complementary, hard to imitate) may extend beyond firm boundaries. Partnerships enable inter-firm learning by helping to recognize dysfunctional routines and develop them.	Identification of critical resources in innovation process. Strategic integration of complementary capabilities in innovation networks leads to better chances for radical innovations.	<ul style="list-style-type: none"> - Recognize and describe own capabilities and critical resources, particularly knowledge based resources from the network point of view; continuous re-evaluation - Develop routines together with partners