Interfirm co-operation and learning within SME Networks - two cases from the Styrian Automotive Cluster

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The issue of knowledge creation, diffusion and learning in clusters and SME's networks has gained growing attention in the recent years. Case studies dealing with these issues have been thus far able to show such learning activities in particular cases with few firms involved. This paper aims now at providing a broader framework for organisational learning at interfirm level than recent case studies. A special focus will put on the systems of knowledge diffusion that prevail between the firms. This will be done in order to show potential leverage points for public and semi-public cluster institutions to foster learning and innovation activities at a micro-level of a cluster.

In a first step firms belonging to networks will be identified through an extensive mapping of formal and informal links. In a second step the presence of learning systems at firm and interfirm level will be examined in detail. A third step then compares the particular differences found between members and non-members of SME networks.

Key words: Knowlegde, SME-networks, organisational learning, co-operation.

1 Introduction

Clusters as units of analysis presume a high density of interaction, co-operation, creation and diffusion of knowledge. In this paper the cluster concept will be interpreted from the perspective of „learning organizations“ to give a description of joint knowledge creation and technology-spill-overs that may take place within clusters. A special focus is put on the different forms and organizational aspects of joint learning. The recent literature (see e.g. Coombs et al. 1996, Dodgson 1996, Senge et al. 1995, Senker/Sharp 1997) suggests that this new approach may offer new findings about clusters and SME networks that go beyond the well known ideas of learning by doing and knowledge spill-overs.

2 Clusters as learning organizations

As a starting point for a definition of cluster it is still useful to refer to Marshal (1920) and his threefold dimensions of cluster-forming effects: Clusters, accordingly, are sets of complementary firms (in production *and* service sectors), public, private and semi-public research and development institutions, which are interconnected by labor market and/or input-output and/or technological links. They are highly competitive because of these links, since they generate a situation which combines the advantages of both the market mechanism and the direct control-structures of a single organization: Firstly, because one has many different firms within a cluster serving many different markets within and out of the cluster, which keeps the forces of competition alive and guarantees a flexible and efficient handling of activities. Secondly, because the interconnections of the agents within a cluster allow for a close co-ordination of activities, the development of strong long term complementarities and the avoidance of external effects (external to the cluster).

This of course raises the question to what extent this competitiveness is automatically created by the existence of these threefold effects or if conscious efforts are needed to maintain and develop the competitiveness of clusters. These efforts may be pursued from the outside of the cluster, e.g. from policy institutions with their goal orientation and consequent instrument use, but they can also be generated from inside the cluster as a co-ordinated attempt of the members of the cluster to improve their relations and links. Clusters, hence, can be regarded as learning organizations, and concepts of learning can be applied to cluster analysis.

In the following we will point to some elements of learning models to be used for such an analysis.

2.1 The nature of learning

The concept of learning has changed considerably in recent years: For a long time learning was primarily considered as an adaptive response by an organism to a change in the environment. According to an essentially behaviorist-reductionist perspective this included the idea of learning as a linear process and as something that has to start from the level of the individual so that learning in a social context can be understood as the aggregate of individual behaviors.

As Cullen (1998, p.4) argues conventional models of organizational learning still retain elements of these positions taking as a starting point an "information processing" model or "black box" conceptualization of learning, where information is converted into knowledge and then action. Applied to the concept of organizational learning, it can be understood as a collective and purposive strategy to achieve the goals of the firm; it can furthermore be extended to the notion of clusters as learning organizations with common goals and shared agendas.

Yet learning cannot only be regarded as a process leading to changes in capabilities and competencies; it has also to be considered as a social process of ongoing development embedded in a socio-cultural (regional) context. Learning then becomes essentially a communicative process rather than a cognitive performance requiring new thinking about the nature and forms of the transmission and dissemination of knowledge within a social and organizational context, such as the firm or a cluster (Cullen 1998, p.5).

2.2 Organizational learning

While learning by doing and agglomeration economies focus mainly on the issue of productivity gains, organizational learning rather deals with the question of the firm’s innovation activities. Learning in this context is regarded as an effort that is pursued actively and strategically. Learning by doing may be considered as something that is carried out passively parallel to the acquisition of new technologies while organizational learning follows clear decisive objectives and may even lead through innovations to the development of new technologies.

„Learning organizations are organizations where people continually expand their capacity to create the results they truly desire, where new and expensive patterns of thinking are nurtured, where collective aspirations are set free, and where people are continuously improving their personal capabilities“ (Senge 1990, p.15). Of particular importance seems to be the interplay of the individual, the team and the organization as a whole. Organizational learning is the

outcome of three overlapping spheres of activity - individual, team and system learning. All three kinds of learning take place simultaneously. Individual learning takes place each time an individual reads a book, performs an experiment, or gets feedback from workmates or colleagues. Team learning takes place when two or more individuals both learn from the same experience or activity. Team learning may involve new ways to address the team's responsibilities, or it may involve some aspect of the interaction between the members of the team themselves. System learning takes place when the organization develops systemic processes to acquire, use, and communicate organizational knowledge (Dixon, 1995).

All those definitions have several characteristics in common. First, learning is conceived as something that is deliberately pursued by the organizations and its members. Organizational learning therefore seems to be something that has actively to be achieved. Second, the learning process is considered as continuous. Thirdly, learning is depersonalized. It is not a person or an elite (the owner or the top management) who is learning (even when he is learning for the organization), organizational learning is a change in the knowledge of the whole organization (Staehle 1991, p.844).

2.3 From organizational learning to an organizational knowledge base

While organizational learning as discussed above happens at micro (team) level the question remains open how a whole organization or network may be able to change its mental model or its routines. Thus in addition to the learning processes a focus has also to be put on the diffusion of the new knowledge and the development of the organizational knowledge base. With regard to Nevis et. al. (1995) three different phases may be distinguished:

1. „Knowlegde acquisition“ - the development or creation of new skills, routines, insights or mental models. DLL leads to knowledge acquisition.

2. „Knowledge sharing“ (knowledge diffusion) - the communication or distribution of the new knowledge or mental models .

3. Knowledge utilization - the integration of the new knowledge into the processes and or structures of the organization. The new knowledge becomes thus publicly available and may be generalized with regard to new situations.

2.4 Knowledge Acquisition (i.e. Learning)

Learning is a conscious attempt on the part of the organization to retain and improve competitiveness, productivity, and innovativeness in uncertain technological and market circumstances. The greater the uncertainties, the greater the need for learning. Organizations learn in order to improve their adaptability and efficiency during times of change (Dodgson, 1993).

In correspondence to concepts developed by Argyris and Schon (1978) have described three basic types of organizational learning:

Single-loop learning (SLL): SLL occurs when errors are detected and corrected and organizations carry on with their present policies and goals. According to Dodgson (1993), SLL can be equated to activities that add to the knowledge-base or firm specific competencies or routines without altering the fundamental nature of the organizations activities. SLL has been referred to as lower level learning by Fiol and Lyles (1985) and adaptive learning or coping by Senge (1990).

Double-loop learning (DLL): DLL occurs when, in addition to detection and correction of errors, the organization is involved in the questioning and modification of existing norms, procedures, policies and objectives. DLL involves changing the organization's knowledge-base or firm-specific competencies or routines (Dodgson, 1993). DLL is also called higher level learning by Fiol and Lyles (1985) and generative learning (or learning to expand an organizations capabilities) by Senge (1990).

Deutero-learning (DL): DL occurs when organizations learn how to carry out single-loop and double-loop learning. The first two forms of learning will not occur if the organization is not aware of the fact that learning should take place. The awareness of ignorance motivates learning (Nevis et al., 1995).

2.5 Knowledge Diffusion

The new acquired knowledge has to be spread through the whole organization or network in order to ensure the learning of the organization as a whole. The faster this diffusion process takes places the more is the organization able to utilize the new knowledge. This diffusion process is also correlated to the adaptability of the firm or network (Nevis/Di Bella 1995). According to Duncan and Weiss (1979) the following conditions are relevant for a successful diffusion of knowledge in organizations:

- **Accessibility of new knowledge:** The successful transfer of knowledge at organizational level is only possible, if the access to this new knowledge is not limited by hierarchies or other intraorganizational boundaries. Knowledge also needs to be codified in order to be broadly available. This is of course only possible with regard to explicit knowledge. Tacit knowledge can be only addressed through personal interaction (Davenport/Prusack 1998). Several tools are available in organizations to ensure the accessibility to knowledge: The possible bandwidth reaches from formal systems such as groupware or intranets to completely informal communities of practice or personal networks (Wilmes 1997). Semi-formal ways to make knowledge accessible are infrastructures like tea-corners, watercoolers or social-rooms (Lipnack 1996).
- **Contextualisation and communication:** The essential prerequisite of knowledge diffusion is communication. The better the communication processes work, the faster the new results of learning activities will be spread through the whole organization or network. Thus a common language should be present at organizational or interorganizational level (Davenport/Prusack 1998). New knowledge will be only absorbed by other members of the organization if can be integrated semantically into the existing personal knowledge base - i.e. contextualized. DLL activities at top management level will for example only lead to changes in the behavior of the organization if this knew knowledge can be contextualized at the middle management and shop floor.

  New knowledge that should be absorbed needs to be relevant for the individual. Thus it should fit to the aspirations and concrete needs of the individual. Relevance of the new knowledge for the individual will only arise, if it is regarded useful for the attainment of the individual and organizational goals (Wilmes 1997). This relevance may not be compatible with the necessary organizational consensus upon the new knowledge. The relevance of the new knowledge to a single individual does not necessarily coincide with other individuals in the organization. Intense communication efforts are necessary to ensure Thus tools like

teams meetings, quality circles or task forces are of particular importance for the successful diffusion of new knowledge in the organizational and also interorganizational context.

2.5.1.1 Knowledge utilisation

New knowledge that has already been distributed (or communicated) through the whole organization/network leads only to new patterns of behavior or routines if it can be successfully integrated into the structures and processes of the organization/network. This integration leads also to a storage of the new knowledge in a physical sense - it is contained in the products and services the firm offers.

The concept of **„Organizational Routines“** (Nelson/Winter, 1982) can help to show how knowledge is utilized and stored in organizations/networks. „Routines reflect what is regular and predictable about a firms business behavior, including characteristics of production, employment and customer service that have become embedded in the everyday operations of the firm“ (Nelson/Winter 1983 p. 15). Thus they resemble individual skills that are trained through permanent practice - they may be regarded as a bridge between individual skills and the patterns of behavior of the entire organization. „Routines over time draw upon and influence ‘organizational memory’. Expressed in another way, routines translate collective ‘learning by doing’ into ‘remembering by doing’“ (Nelson/Winter 1983 p. 15). Routines enable organizations to store knowledge in the patterns of business processes that emerge over the time.

The idea of **core competencies** (Itami 1987) may also help to understand how new knowledge is utilized. The Core-Competence of a corporation is defined as the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies (Prahalad/Hamel 1990). Thus it may be assumed that core competencies develop through the continuous process of knowledge utilization. The result is an skill and learning based competitiveness. This skill enables a company to develop new products swiftly, enter new markets quickly, to become capable of infusing products with irresistible functionality or, better yet, creating products, that customer need, but have not even imagined (Prahalad/Hamel 1990).

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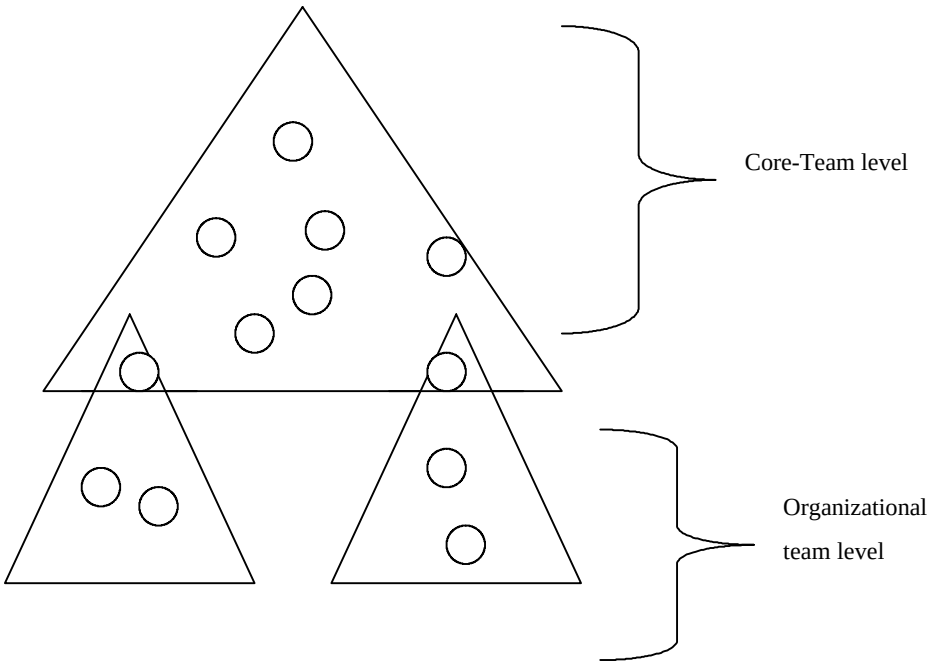
4 Case study 1: Learning and knowledge diffusion through continuous improvement in a network

4.1 Brief description of the network

The network in focus of this case study consists of seven partners being all suppliers to the automobile industry in the metropolitan area of Graz. The areas of activity reach from metal processing to the production of tool and tool related components. The specific objective of this network is the development and improvement of new routines in the daily work of each of the partners. In particular it is intended to introduce continuous improvement processes both at firm and interfirm level in order to adapt to the quality norm QS9000. The network has a particular design - it consists of overlapping teams. At interfirm level there is a "core team" consisting of members of all seven firms. These members are at the same time the facilitators in the working teams at firm level:



Thus all teams are interlocked through carefully selected people. While the firm-level-teams have the task to introduce continuous improvement in the individual organization the core team deals with problems and issues that have arisen at firm level. The meetings in the core team serve thus on the one hand as a platform for discussions, on the other hand they aim at learning and problem solving among the team members. Every meeting at network level is

dedicated to one specific topic that all members have agreed upon. An external facilitator ensures the acquisition and documentation of the concrete results.

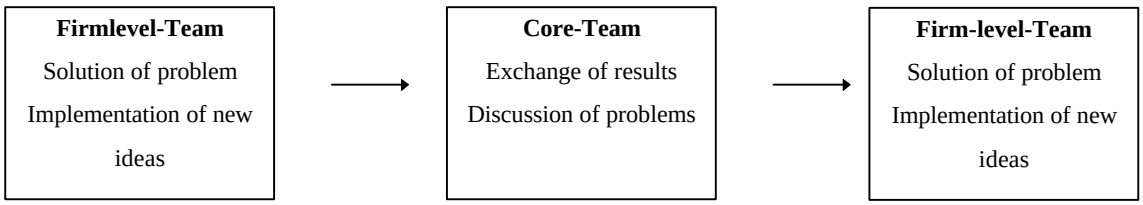
4.2 Knowlegde acquisition

Knowledge is acquired through learning processes at both levels of the network. These learning processes take place at the regular team meetings.

- At the firm level the teams acquire new knowledge through learning at the weekly team (Gemba Kaizen) meetings. Several tools like the "Ishikawa-Diagram" or the PDCA-Cycle help to analyze existing problems and to develop appropriate solutions. Each meeting lasts exactly for one hour and has a fixed time schedule, that is facilitated by the team leader. Problems addressed at the meeting have to be put on the agenda in the days before the meeting. The issues dealt with are for example improvements in the work security or improvements of the working process at the shop floor.
- At the core-team-level knowledge is also acquired at the meeting that take place twice a month. At these meeting the same tools are employed as at the firm level but the problems that are dealt with differ. The core team deals with technical problems that have arisen in the implementation process at firm level. Thus the solutions developed in these meetings aim at the different continuous improvement teams in the seven partner firms and not at problems that can be solved at firm level. Thus the core-team deals somehow with "meta-improvements" that are valuable at firm and interfirm level.

4.3 Knowledge diffusion

Knowledge diffusion takes in this network place at two different levels. At each level the interlocking team member play an essential role.



- Knowlegde acquired at firm level is spread to the members of the other firms through the core team meetings. The facilitated core team ensures the proper communication and contextualization of the new knowledge.
- Knowledge acquired at the core team meeting diffuses through the interlocking members to the firms. It is a particular task of these members to ensure the proper transfer of the new knowledge into his or her firm.

4.4 Knowledge utilisation and storage

The distributed knowledge in this network is employed and stored in two different and complementary ways:

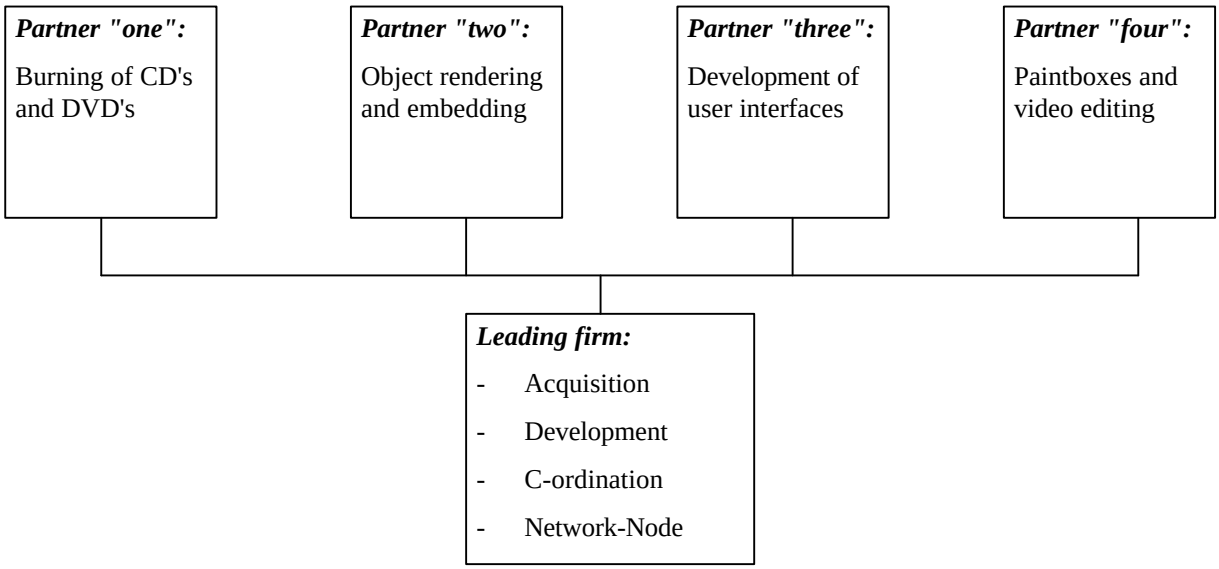
- Codification of the results of the meetings: The facilitator has also the task to write down minutes of every meeting. According to the principles of continuous improvement they have a particular form defining results, arising tasks and corresponding responsibilities. All minutes and information material is stored on a server that is accessible through the intranet of the seven partners.
- Employment of the new knowledge in procedures and routines: In particular at firm level each meeting should lead to concrete improvements in the business and/or production processes of the firm. Thus continuous improvement aims at the permanent incremental reshaping of existing routines. New ideas developed at the core team may be also utilized at firm level among all seven partners. They are introduced through the diffusion process and can then lead to particular applications at the Gemba Kaizen Meetings.

5 Case study 2: Learning and knowledge diffusion in a network of multimedia enterprises

5.1 Brief description of the network

The network in focus of this case study consists of 5 partners belonging to the young information technology sector in the metropolitan area of Graz. The area of activity consists mainly of the development of computer based simulations for the automotive industry. Such simulations are for example able to visualize the specific functions of a new four wheel drive system or the show the processes of a just in time co-operation. The simulations serve on the one hand as public relation tool on the other hand they also fulfill educational purposes. The specific objective of this network is the fast and flexible development of such multimedia

applications for the leading enterprises in Styria but also for international clients. Due to the required speed and flexibility the structures and processes in the network are not formalized. Mainly the partners co-operate via e-mail or remote access to a server shared by all the partners. Thus the network in focus may be described as a loosely tied virtual enterprise centered around one leading actor:



Occasionally - in particular when a new project is started - meetings are held in order to assign tasks to the different partners and to discuss problems that may arise during the project.

5.2 Knowlegde acquisition

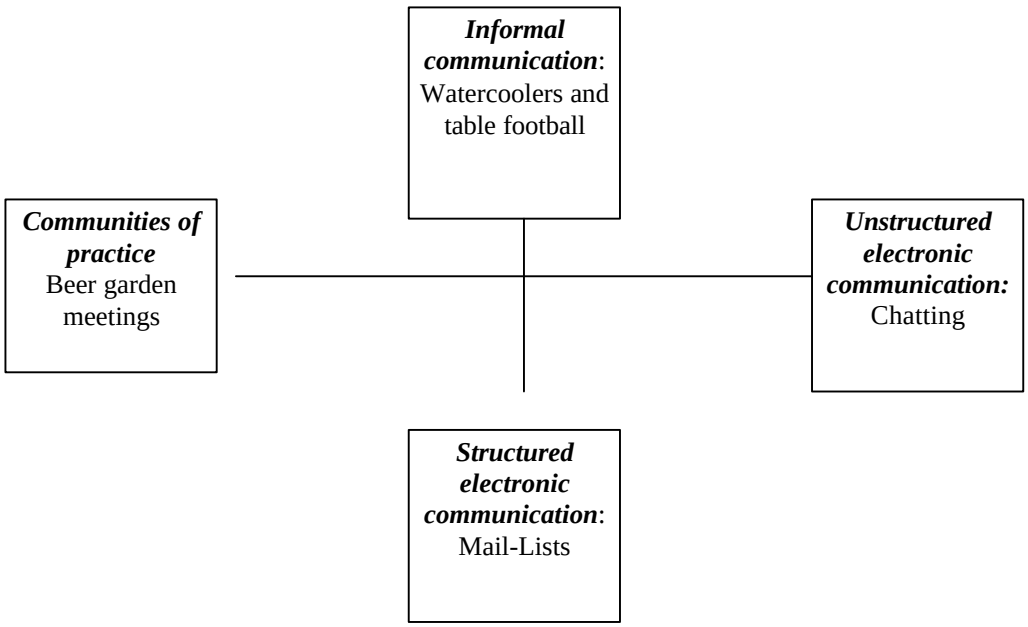
Knowledge is acquired through learning processes at firm and at network level. These learning processes take place at firm level in formal and informal team meetings. At network level learning occurs at the occasional meetings of all partners but - more important - through the communication between the members via e-mail and chatting (i.e. online discussion).

- Chatting and e-mail discussion lists: Especially chatting is preferred as a non compulsory way to discuss problems and ideas that arise out of the current work. Chatting offers in contrast to e-mails a online bi-directional way for communicating and is also open to the entry other discussants. The e-mail discussions are organized in facilitated mailing lists - every mail posted there is first reviewed by the facilitator. This ensures that only relevant contributions are posted an the particular list. The themes of the list are usually centered around projects of the team.

- Informal and formal meetings: Meetings that take place at firm or interfirm level are also important occasion for learning (i.e. knowledge acquisition). Of special importance are the meeting places: The leading firm has not only a water-cooler they also offer a leisure room with table football for their employees. Informal interfirm meetings take often place during summer in the beer gardens of the neighborhood. These informal meetings function in particular as communities of practice that may generate double loop learning.

5.3 Knowledge diffusion

Knowledge diffusion takes in this network place on the one hand through electronic communication on the other hand it is ensured through the informal meetings at firm and interfirm level.



- Electronic communication: Both the chat-room[1] and the discussion lists are accessible by everybody in the network. Thus the systems of knowledge creating/acquisition and diffusion are overlapping to a large degree. New acquired knowledge is immediately spread in the network. The new medium of communication also enables the members of the network to communicate without the necessity to leave their work - thus problems and arising questions can be discussed without leaving the working place.
- Informal meetings: The informal meetings as described above functions also as systems of knowledge diffusion. This diffusion process is threefold: First new created or acquired

[1] Virtual discussion room on basis of the internet protocol

knowledge at firm or network level is spread immediately among the participants second acquired at firm level may be spread in the beer garden or other informal network meetings and third knowledge acquired at network level will be spread at the informal meeting places at firm level such as for example the watercooler.

5.4 Knowledge utilisation and storage

Due to the more informal structures and processes of this particular network the ways of knowledge storage and utilization

- Storage in databases: The network in focus uses mainly electronic means of knowledge storage. Especially the mail-lists have large electronic archives that are accessible by all members of the network. Queries through keywords at the database-server are possible and often used during the preparation time of a new project.
- Contribution of the new knowledge to core competencies: The new knowledge that has been acquired and distributed at firm and interfirm level will be directly integrated into the working process. Thus the learning contributes continuously to the development of core competencies both at firm and network level. These gains through specialization lead to a increasingly high speed and flexibility in project development both necessities to remain competitive in a dynamic and complex market.

6 Summary and conclusions

While the concepts of single and double loop learning have been successfully applied on interorganizational teams or small groups the problems of knowledge diffusion and utilization beyond the limits of such groups The cases shown above demonstrate how such knowledge acquired through single- and double-loop learning may be spread through a whole network.

In the first network this happens through a structured framework established in the change management process. Rules, roles and responsibilities are precisely defined. The learning systems that prevail in this network can be described as participative. Also the utilization of the new things learnt is ensured through the design of the network.

The second network is by far less structured than the first. Both learning and knowledge diffusion happen at a more or less "ad hoc" basis. The means of communication are mainly informal and /or electronically. The utilization of the new knowledge gained takes also place in informal ways. These facts reflect also the "pioneer like" character of this new technology intensive branch.

The two case studies highlighted in this paper are able to demonstrate that new mental models acquired through double loop learning can spread beyond the limits of the team where they have been generated. They also show ways of utilizing these new "lessons learnt". The concepts of routines and core competencies can be also applied in this context.

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