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Multi-channel innovation networks

Learning and innovation in networked global economy

Content

Abstract

In global economy competitive advantages of firms are based on their ability to search globally new knowledge. Firms are looking for effective channels to acquire knowledge. They participate in several networks to have access on relevant information and new knowledge. The aim of this article is to provide an overview of different channels or networks that firms are using in acquiring new knowledge. My thesis is that effectiveness of a knowledge searching channel is dependent on the type of knowledge looking for. To understand and develop these channels the concept of knowledge must be taken on focus. Here I refer to differences between tacit and explicit knowledge on the one hand and between knowledge and information, on the other hand. My treatment is divided into three parts. Introduction provides background for the second part by presenting the basic issues of knowledge creation like different concepts of knowledge, innovations and knowledge searching. The second, major part identifies several networks used in knowledge acquisition from communities of practice to global knowledge transfer. In the final part a new classification of search networks for knowledge is outlined. It defines four basic types of search networks based on characters of links. Finally a possibility to develop a multi-channel innovation networks model is explored. The article is theoretical and it is based on the relevant literature. So the taxonomy of search networks and the model presented are heuristic and hypothetical. A further elaboration of the model is needed, especially based on empirical studies on different networks.[1]

Introduction: knowledge creation

In global economy knowledge creation and innovation processes are distributed all over the world. But this does not mean that there is knowledge everywhere. Knowledge is concentrating to certain hubs, like Silicon Valley or Cambridge, UK. Firms' competitiveness is essentially dependent on their capability to manage knowledge creation in this kind of globally distributed environment.

To understand the basic issues of knowledge creation and innovation, concepts of knowledge must be considered carefully. The distinction between explicit and tacit knowledge is commonly accepted in knowledge management literature. Ikujiro Nonaka made the distinction popular by his book The Knowledge-Creating Company written with Takeuchi (1995). To quote from a later article (Nonaka et al. 2000):

> "There are two types of knowledge: explicit knowledge and tacit knowledge. Explicit knowledge can be expressed in formal and systematic language and shared in the form of data, scientific formulae, specifications, manuals, and such. It can be processed, transmitted, and stored relatively easy. On the other hand, tacit knowledge is highly

[1] This article is a part of the larger research project *Global knowledge transfer* funded by Sitra, The Finnish Innovation Fund. My special thanks for discussing issues of this article are due to Henry Chesbrough, Paul Duguid, Martin Kenney, Yikuan Lee, Raymond E. Miles, Don Patton, Charles Sabel, AnnaLee Saxenian, Sanjit Sengupta, Anssi Smedlund, Petri Vasara, and Liisa Välikangas. Paul Duguid read an early draft of the paper and proposed to divide it into two articles, one dealing with basic concepts of knowledge and the other for analyzing search networks. This article is the latter, and the former is Hautamäki (forthcoming).

> personal and hard to formalize. Subjective insights, intuitions, and hunches fall into this category of knowledge. Tacit knowledge is deeply rooted in action, procedures, routines, commitment, ideal, values, or emotions. It "indwells" in a comprehensive cognizance of the human mind and body …. [T]acit knowledge and explicit knowledge are complementary to each other, and both types of knowledge are essential to knowledge creation."

The book launched a very sophisticated methodology of knowledge, called SECI-model. In SECI model there are four conversions between tacit and explicit knowledge: Socialization (t->t), Externalization (t->e), Combination (e->e) and Internalization (e->t). Socialization is basically building joint experiences and internalization is learning by doing.

For the purpose of this article I have to make a reservation to Nonaka's model. The conversations between explicit and tacit knowledge are not possible in large scope. In SECI model tacit and explicit knowledge are seen to be quit separate. But if we go back to the original concept of tacit knowledge, presented by Michael Polanyi, we will realize that tacit knowledge is a dimension or component of all knowledge (see Polanyi 1958 and 1966).

Polanyi's distinction between tacit and explicit knowledge is based on his distinction between focal and subsidiary awareness. To understand these distinctions a tool metaphor is helpful. In all actions (bodily or mental) people use tools to achieve something. Say, we use a hammer to drive a nail. Our awareness is directed to nail. We feel the palm in our hand. Polanyi said that we have a subsidiary awareness of the feeling on the palm in my hand which is merged into my focal awareness of my driving in the nail (see Polanyi 1958, 55). These two kinds of awareness are mutually exclusive in the sense that if you direct your awareness to your action or skill you loose your focal awareness. Then you could make some part of tacit knowledge explicit; that part is implicit knowledge.

Tacit component is always present in knowing, thanks for example to the tacit element in perception, in language use and even in problem solving. According to Polanyi, tacit knowledge is more fundamental than explicit knowledge. So we can understand the strong statement: we can know more than we can tell and we can tell nothing without relying on our awareness of things we may not be able to tell. Things we cannot tell, we know by dwelling them. Tacit knowing is knowing by indwelling. So we could state:

Polanyi's thesis of knowledge: knowing always contains a tacit dimension.

In dominating philosophical tradition knowledge is taken to be propositional (see Williams 2001). Knowledge is expressed by that-sentences like I know that Helsinki is the capital of Finland. Gilbert Ryle called this kind of knowledge know-that in his famous book The Concept of Mind (1949). But there exists also other kind of knowing, that Ryle called know-how. We see know-how in many actions and performances like in swimming, playing piano or even inferring. Ryle's main point in his treatment of know-how is that know how doesn't presupposes that a person who knows how to act also knows some propositions (say rules, instructions or so). We could pose the following thesis

Ryle's thesis of knowledge: knowing how does not presuppose knowing that.

In developing the theory of knowledge creation it is important to understand the difference of knowledge and information. In simple terms, information is literally or symbolically codified knowledge, transmitted by speaking or by physical devices like books or digital files. Information

is structured data. It can be measured by bits (or by words). In information society we have effective devises (computers, communication channels, Internet) to deal with information.

To define knowledge anew, we have to combine the standard account of knowledge as propositional knowledge and the emerging account of know-how and tacit knowledge (Ryle, Polanyi, Nonaka etc.). First of all, knowing is always personal, it's knowing by somebody. The subject of knowing always understands and interprets propositions in his/her own way. This means that he reads out the meaning of propositions by integrating them to his own context of practice and other knowledge. In turning information to knowledge a tacit dimension is always present (in interpretation, in integration, in justification and in practice). To be knowledge the information must be known by somebody, in the sense describe above. We can say also that in information the knower is abstracted away (knowledge for "anybody") whereas knowledge is always related to some knower in a certain context (knowledge for somebody). So we could state

Thesis of knowledge: personal interpretation turns information into knowledge

Knowledge creation is always a social process in two senses. New knowledge could be created only by building on the base of accumulated cultural-historical knowledge. This base is mediated by communities and by artifacts. Artifacts mean in this context materialized or embodied knowledge in the form of models, theories, designs instruments, tools and practice. The concept of embedded knowledge is used to refer to this kind of conceptual artifacts (see Nielsen&Nielsen 2006). What is important here is that embedded knowledge could be activated or appropriate by using these tools and learning to read out their meaning. Although we are not going to explore the role of embedding knowledge in this article, it's good to remember that conceptual artifacts are present in all knowledge creation and that now knowledge will be embedded later to some forms of artifacts. In fact, even information can be seen to be embedded knowledge. The role of communities in knowledge creation, on the other hand, is the central issue of this paper and we will turn to it in several occasions.

There seems to be a bias in knowledge management studies concerning the role of scientific knowledge in innovation. Almost exclusively inter-firm networks are notified as knowledge acquisition channels. There the stress is very much on the tacit dimension of knowledge. However, the knowledge economy is based on scientific research and on applications of scientific knowledge to practice. Modern technology (IT, nuclear power, biotech, nanotech etc) is made possible by research and development based on scientific research. Research and development activities in economy (in universities, in other R&D institutions and in firms) are among the major factors of economic growth and competitiveness (see Helpman 2004). Especially important are "general purpose technologies" like steam engines, electricity and the computer.

The effects of scientific knowledge and technologies to the growth of economy are dependent on the knowledge diffusion in economy. There are many channels of knowledge diffusion. One is undergraduate and post-graduate education given by universities. What I like to emphasize here is the industry-university collaboration.

The basic value or meaning of universities lies in their possession of expert, specialized, theoretical knowledge. The overriding norm for universities is to establish valid knowledge through systematic inquiry (see Geiger 2004). The products of systematic inquiry are scientific theories. Scientific theories as well as other results of research are normally presented in literary form as reports. Many times the core information is codified into sets of mathematical formulas and into other symbolic presentations, called models.

In general terms, theories describe phenomena and their internal dependencies. Theories contain a set of concepts (terms), a set of laws, and a set of correspondence rules which connect some of the concepts of theory to observable phenomena. Theories postulate entities and dependencies that are not normally observable. So they could be known only by theories. Therefore I like to call scientific, theoretical knowledge deep explicit knowledge. So we summarize concepts of knowledge in the figure 1.

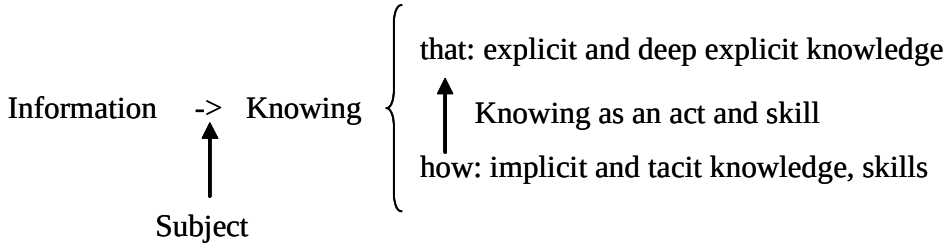

Figure 1. Information, know-that and know-how

Knowledge creation and knowledge transfer in distributed environment is dependent on types of knowledge and information firms are looking for. Information is quite easy to transfer but hard to select. Explicit knowledge transfer is based on sharing interpretation of information, so it presupposes sharing of expertise. Especially to understand deep explicit knowledge a good scholarship is needed (like university education). Tacit knowledge must be learned by doing, sharing similar practice. So a master-novice learning model is the ideal type on transferring tacit knowledge.

John Brown and Paul Duguid have shown the role of practice in knowledge creation and transfer (see Brown&Duguid 2000). People who work together and share similar practice forms communities of practice. They have the same kind of tacit knowledge. Tacit knowledge is "sticky", meaning that it's difficult to transport to other people who don't share similar practice. On the other hand, there are networks of practice in which people who don't even know each other could change knowledge about the practice if they share it. Explicit knowledge and information is "leaking" in networks of practice (Brown&Duguid 2001, 2002).

Knowledge is not interesting to firms as such. Knowledge is needed in improving the performance and productivity of companies and to create innovations. So knowledge is an asset in competition. David Teece and his colleagues have developed a theory of dynamic capabilities to analyze the sources and methods of wealth creation and capture by private enterprise firms operating on rapid technological change (see Teece at al. 1997). The background of their analysis is Schumpeterian observation that competitive advantage requires both the exploitation of existing internal and external capabilities, and developing new ones. Dynamic capabilities reflect an organization's ability to achieve new and innovative forms of competitive advantages given the path dependencies and market positions.

According to the theory competitive advantage of firm lies with its managerial and organizational processes, shaped by it specific asset position and the path available to it. Organizational processes have three roles: coordination, learning and reconfiguration. Learning is here seen to be a process by which repetition and experimentation enable tasks to be performed better and quicker. The asset position of a firm refers to its specific assets including technological and knowledge assets. Firms current position and its opportunities are shaped by the evolution path it

has traveled ("history matters"). Teece et al. notes that "collaboration and partnership can be a vehicle for new organizational learning" (Teece et al. 1997).

The core of this article is to analyze different forms and channels of "collaboration and partnership" from the viewpoint of learning and innovation. I see learning or adaptation of new knowledge to be a tool for producing innovation. Innovation is introducing something new and useful (better performance, new products and services, new business models, novel networking etc.). It's commonplace to separate incremental and radical innovations. Clayton M. Christensen makes a different distinction between sustaining and disruptive innovations (1997). Disruptive innovations create new markets or reshape existing markets. For him incremental and radical innovations are two forms of sustaining innovations (see Christensen et al. 2004). Radical innovation provides dramatically improved performance along an established performance trajectory.

One quite general way to separate search and learning is to use the dichotomy of the exploration of new possibilities and the exploitation of old certainties in organizational learning, presented by James G. March 1991. According to March exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. On the other hand exploitation includes refinement, choice, production, efficient, selection, implementation and execution. An organization like firms must find a balance between exploration and exploitation, because engaging in exploration to the exclusion of exploitation exhibits too many undeveloped new ideas and too little distinctive competence, where as engaging in exploitation to the exclusion of exploration cab lead to suboptimal equilibria. Because returns from exploration are systematically less certain, more remote in time, and organizationally more distant from the locus of action and adaptation as compared to returns from exploitation organizations have tendency to substitute exploitation of known alternatives for the exploration of unknown ones. Thus adaptive processes become self-destructive in the long run. It's important to note that radical and disruptive innovations are emerging mainly form exploration of new alternatives.

We can approach the issue of innovation also from the viewpoint of problem solving. Roughly, there are two kinds of problem solving. One is solving clearly stated problems and the other is identifying new problems. Identifying problems is quite different activity than solving known problems, because "to see a problem is to see something that is hidden", Polanyi said aptly (1966). So identifying a problem is based heavily on tacit knowing. In many cases identifying new problems and solving them is possible only by combing different knowledge. Innovations are basically new combinations of different assets. So the issue here is how to find and combine new knowledge. This leads us to the problem of searching new knowledge for innovation.

In this paper the focus is on analyzing different channels and networks for searching knowledge. The basic distinction is between exploration networks and exploration networks. By exploration networks I refer to networks for search new kind of knowledge or complementary knowledge, needed in identifying problems and in radical and disruptive innovations. By exploitation networks I mean channels for learning available tacit knowledge. Of course, this distinction is not exclusive, and sometimes it's impossible to separate exploration and exploitation networks.

It turns out that proximity is an important factor of knowledge creation. Proximity helps collaboration and getting to know new people. This leads to separate three kinds of knowledge searching networks based on proximity: guilds, agoras and alliances. Guilds are communities of practice or local networks of practice, based on strong, but informal ties, Agoras are places to

meet and chat like restaurants, parties, clubs, shopping malls etc based on weak links between acquaintances.

Especially important to knowledge searching is the close co-operation or collaboration between firms. This is inter-firm collaboration between, say firms and their (distant) suppliers, customers or allies. Outsourcing and off-shoring are also forms of this kind of distant collaboration. I use the term Alliance to refer to networks, which are based on formal treaties or agreements between parties.

Although local connection might be fruitful for knowledge shearing (cf. Silicon Valley's ecosystem), networks for searching knowledge from distant places and sites are becoming extremely important in global economy. Also there we can make a distinction between weak and strong links. Exhibitions, conferences and fairs are places or episodes where unknown people meet each other and share information, make friendship and network. Let's call them all Fairs. On the other hand, to get access to deeper knowledge situated in a distant place, one has to build a settlement there. I like to call this kind of distant units Diasporas.

All five types of networks are based on temporary or more permanent face-to-face meeting and collaboration, either in local or distant sites. On the other hand the dissemination of information technology and global access to broadband networks is not only helping personal communication, but also creating totally new forms of information sharing and collaboration. We use the metaphor NetGora to refer to web sites for sharing information.

These concepts of networks have emerged from the analysis of literature dealing with knowledge management and networking. This analysis and comparisons of different concepts is presented in the next part of the article. In the final part observations are collected and the above distinctions and channels are introduced. Finally, all things are collected into multi-channel innovation networks model. It must be taken to be a heuristic model helping firms to analyze and develop search networks for new knowledge. To test and elaborate it empirical studies must be conducted. To be lucky, such research is under work, and several modification and elaboration will be seen later.

Networks for learning and innovation – overview and comparisons

Networks are collections of nodes (persons, groups, organizations) and links or relations between them. The strength of links defines the structure of a network. In social studies it is common to distinguished strong and weak links. Strong ties bind close friends together (circle), whereas weak ties connect the members of close friendship circles to their acquaintances. Mark Granovetter proposed in his famous article The Strength of Weak Ties (1973) that a person's (eco's) weak ties to acquaintances (alters) are even more useful than strong ties for finding a job, getting news etc. Barabási writes that the weak ties or acquaintances are our bridge to the outside world, since by frequenting different places they obtain their information from different sources than our immediate friends (Barabási 2002, 43). Especially locations and positions (status) of people provide them with useful information about opportunities and choices otherwise not available.

Social capital is a kind of capital, namely investment in social relations with expected returns in the marketplace. The idea behind this definition is that individuals engage in interaction and networking in order to produce profits (see Lin 2001). According to Nan Lin social capital means

resources embedded in social structure that are accessed and/or mobilized in purposive actions (Lin 2001, 40). Trust is defined in this context to be a confidence and expectation that other people will take ego's interests in account in exchanges. Higher trust means lower costs for social transactions.

A case in point is a linkage called a bridge, which is the sole links between two individual actors in a social network (see Burt 1992). Bridges allows individual actors in one circle to have access to resources embedded in links in another circle that otherwise would not be accessible. We make a useful distinction between direct bridges and mediated bridges. A person or an actor (b) who is the only link of a circle A to another circle C forms a direct bridge between these two circles. On the other hand, a person or an actor (B) who has links to two separated circles A and C forms a mediated bridge between them. The actor B is in the role of broker by mediating connection between A and C (see Figure 2).

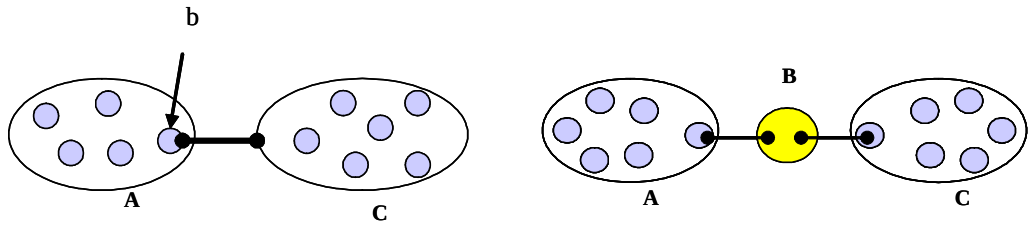

Figure 2. Direct bridge b (left) and mediated bridge B (right) between two separate circles A and C

A note about IT-channels is in order here. In global networked economy firms are turning to be "network enterprises" whose businesses are performed by ad hoc networks (see Castells 2001, Benkler 2006). The basis for the emergence of network enterprises is in computers and Internet-technology: economy is organized by around computer networks. These networks are global, flexible and adaptive. Computer networks provide a huge enlargement of networks connection of individuals and firms. So the network effect if increasing: the more nodes there are in the network, the greater the benefit of the network to each individual node (Castells 2001). Nan Lin emphasizes that the rise of Internet and cybernetworks signals a revolutionary growth of social capital: cybernetworks open up new possibility of global reach of social capital (Lin 2001).

Walter Powell shows in his classical article Neither market nor hierarchy: Network forms of organization (1990) that the network form of organizations is prevalent in many knowledge based industries. Networks are reducible neither to markets nor to hierarchical relations. The network form of organization is based on the complementary strengths and reciprocity between the participants; it's collaboration between organizations which are interdependent in knowledge creation. For knowledge-intensive industries, collaborative networks can be the only way to access crucial knowledge. According to Powell "a basic assumption of network relationship is that one party is dependent on resources controlled by another, and that there are gains to be had by pooling of resources" (Powell 1990, 303). The basis for collaborative networks is complementary strengths of participants and the norm of reciprocity (equal sharing).

Powell and his colleagues are speaking about networks of learning. A network of learning refers to a network form of organization in which know-how and resources are pooled across organizational borders in the absence of market-based or hierarchical relations. Learning takes place in collaboration across organizations based partly on formal ties and partly informal change of ideas and knowledge (Powell at al. 1996).

Learning by collaboration could happen in different arrangements, like relationships with suppliers, intermediaries, customers, investors, other firms, government institutions, and other organizations (see von Hippel 2005, especially concerning user innovations). The inter-organizational learning is a function of the form and strength of the organization's interdependence with its learning partners and its openness to share knowledge and to interact closely with partners. Learning is dependent on the absorptive capacity of a firm: ability to recognize and value new knowledge, ability to assimilate new knowledge, and ability to commercialize new knowledge. It is also known that openness, prior experience on related projects, channels of interaction, and trust are positively related to the effectiveness of knowledge transfer (see Mohr&Sengupta 2002 and Yli-Renko et al. 2001).

Networks of innovation are mainly networks for searching new resources and knowledge across distant fields of expertise. It would be wise to keep the concept of networks of innovation separated from the more general concept of networks of learning, because learning is a different process than innovation, although related (see Brown&Duguid 2001). Gilbert Ryle made this point quite clear in the following quote:

> "Learning how or improving in ability is not like learning that or acquiring information. Truths can be imparted, procedures can only be inculcated. And while inculcation is a gradual process, imparting is relatively sudden." (Ryle 1969, 59).

In innovation both imparting new information and inculcating new skills are present. The function of innovation networks is to provide access to new know-that as well as new know-how.

The basic hypothesis of this paper is that different kinds of networks are built and used for acquiring and learning different kinds of knowledge. The search of new information uses Internet and other web-based networks, conferences, meetings of professionals, informal and personal networks etc. Tacit knowledge is learned in professional teams, in permanent interaction. There are natural networks of practice joining experts of the same practice. Mixing different kinds of knowledge presuppose close collaboration between experts from different industries, disciplines and experiences. It could happen in inter-firm projects or inter-firm networks. Now we will present most important networks for knowledge creation based on recent studies in knowledge management and organizational studies.

Communities of practice and their networks

A central concept used in studying learning networks is that of community of practice. Leve and Wenger introduced the concept of communities of practice (COP) in their book Situated Learning (1991). Community of practice refers to a group of persons with particular skills or expertise, who interact formally within an organization, or informally – but routinely – in a network for shared pragmatic or knowledge-related goals. Brown and Duguid describe the communities of practice as follows (Brown&Duguid 2000, 143).

> "They (COP) are relatively tight-knit groups of people who know each other and work together directly. They are usually face-to-face communities that continually negotiate with, communicate with, and coordinate with each other directly in the course of work. … [G]roups like this cultivate their own style, their own sense of taste, judgment, and appropriateness, their own slang and in-terms."

COPs are formed to solve practical problems that are addressed by a group of people working together. The knowledge in COPs is crystallized patterns of solving problems developed in the course of practical experience (see Hakkarainen et al. 2004, 141). But the functions and effects of these COPs are not restricted to problem solving. According to Brown and Duguid, COPs provide the work context within which members construct both shared identities and the social context that helps those identities to be shared (Brown&Duguid 2001, 202). So members of COP share identity, knowledge, and practice.

Brown and Duguid emphasize the primacy of practice: distinct practices make the communities, and so identities and knowledge, distinct (Brown&Duguid 2001, 2002). They mean by practice undertaking or engaging fully in a task, job, or profession. Polanyi might say that the personal commitment constitutes the practice. But practice is more than commitment: it is acting and doing something concrete with objects by using tools.

A pragmatist philosopher John Dewey expresses practice in a very impressive way (Dewey 1926). Practice is a process which changes objects to serve us better. Believes are tools or instruments in this changing process. Mind is not an outsider observer; mind is inside the world participating in its processes. Knowledge is created when people are active partners of the moving world. There is no scarp separation of facts and values, because practice is goal oriented and so dependent on values.

Going back to communities of practice, we could now say that a community of practice is a group of people committed personally to the same practice, goals, tools, and objects. In a community of practice new tacit and explicit knowledge is emerging. Every communities of practice create their own shared standard of excellence. To become a member of community of practice doesn't happen by reading some manuals, but by starting to do what other members are doing, imitating, tutoring, training. In many communities of practice literal prescriptions of conduct are lacking. Standards are tacit knowledge embedding to skills and practice. The rule of learning is "follow your master".

Communities of practice are learning sites: learning a practice involves becoming a member of a COP. Practice is not restricted only to some location. There are often several communities sharing similar practice and knowledge, and also developing similar identities (technician, chemist, programmer, lawyer, middle manager, Apple enthusiast etc.). This is the base for knowledge sharing. Brown and Duguid write that "[t]hese practices in common … allow people to form social networks along which knowledge about practice can both travel rapidly and be assimilated readily" (Brown&Duguid 2000, 141). These kinds of networks are called networks of practice by Brown and Duguid. According to Paul Duguid, network of practice is collective of all practitioners of a particular practice (Duguid 2005).

What is important here is that people with similar practice can communicate even though they don't know each other. Where practice is common, communication can be global. We see this from the development of science, too. Chemists, electronic engineers, sociologists, or philosophers can understand each other and share a great deal of knowledge relatively easily. To use the terminology of this paper, we can say that members of a network of practice are capable to interpret the same information about their practice in the same way thus reading out the same knowledge, roughly.

Ties or relations between members of networks of practice are looser than those within a community of practice (see Brown&Duguid 2001). Often, communities of practice are local,

situating in one organization or in a local cluster of organizations, although some members might work at distance. Because a practice can normally be learned and updated only by becoming a member of a community of practice, all members of a network of practice belong to some community of practice (in universities, research labs, firms etc.).

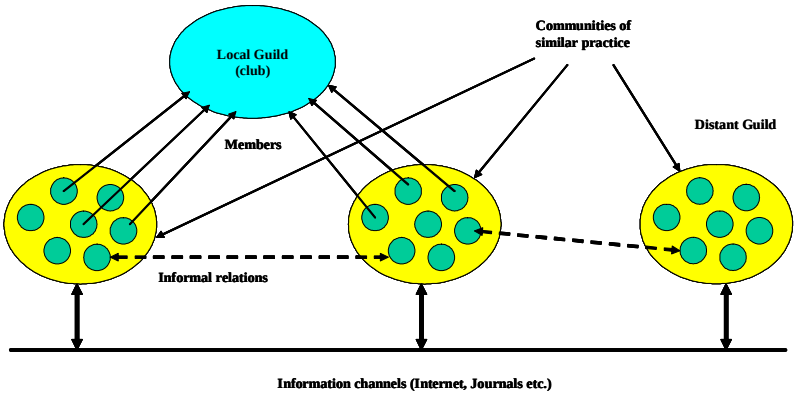

Figure 3. Networks of practice between members of communities of practice based on similar practice.

It's useful to introduce one new, relevant concept here, namely "guild". Guild means a corporation or association of persons engaged in kindred pursuit for mutual protection, aid, development of skills etc. Guilds of professionals are one form of networks of practice. In guilds professionals share ideas, talk about their joint practice, form new relations, network etc. There are also many channels to share information about the profession and practice (journals, wed-sites, email lists etc.) And of course, many experts have informal relations based on fellowship in collages and universities, in previous workplaces etc. So the structure of networks of practice can be presented as in Figure 3. In Figure 3 there is also a distant "site" or departments of guild, called Diaspora in this article.

Communities of practice are "tight-knit" groups of people which share same practice, goals, tools, and objects. There are strong ties between participants of the communities of practice and random and unsystematic connections with external communities. Often, communities of practice are teams inside large organizations like firms or research labs. Because of the closed and intense nature of communities of practice, they are ideal to solve clearly stated (hard) problems. But for innovation more is needed.

Innovative knowledge communities

The Schumpeterian notion of innovation is that innovation is a new combination of existing resources and know-how (Schumpeter 1934). Innovation involves building coherent systems of complementary knowledge. Complementary knowledge and new combinations are more likely to emerge across distant fields of expertise (see also Lehenkari 2006). Therefore, innovation presupposes collaboration of experts from different organizations and from different backgrounds.

Solutions to well-stated problems are innovations, but even more innovations are introducing something new. So it turns out that communities of practice are not the only type of communities

expected (useful) in knowledge economy. To produce new knowledge a different kind of communities are needed. Hakkarainen and his colleagues call these innovative knowledge communities (IKC, Hakkarainen et al. 2004, Chapter 10). IKCs differ from communities of practice (COP) in many ways. IKCs are deliberately designed to create new knowledge. COP applies crystallized knowledge where as IKC transforms fluid to crystallized knowledge. So the crystallized knowledge of IKCs is changing rapidly. IKCs are exploring new areas of knowledge and crossing borders. Their work is comparable to scientific inquiry in that they advance knowledge by forming hypotheses and testing them in practice. IKCs are also deliberately designed to capitalize on cognitive diversity, and members are intentionally picked to complement existing knowledge and expertise. In innovative knowledge communities there are strong ties between participants and heterogeneous connections with other expert cultures, deliberately created for supporting knowledge creation.

Of course, both concepts of COP and IKC are idealized and there are varieties and mixed forms. Essentially we can characterize them so that

- a community of practice is a closed homogeneous group of people solving problems based on available crystallized knowledge (exploitation)
- an innovative knowledge community is an open heterogeneous group of people creating intentionally new knowledge (exploration).

Conceptually, innovative knowledge communities try to evade the danger of all tight-knit communities to become exclusive and to reject new ideas. Brown and Duguid say referring to business organizations that "as any group develops in the direction of its unique practice, insights, and knowledge, it may develop away from the other groups with which it must work … The creation of local knowledge, then, is likely to create simultaneous problems for coordination" (Brown&Duguid 2000, 153-154). So this kind of isolation may dampen creativity and innovation.

Communities of practice are often too closed to be adaptive to new ideas. Therefore, the concept of innovative knowledge community was introduced. They are deliberately designed to create or build new knowledge. Also networks of practice are suitable to share knowledge about a specific practice. So it seems that networks of practice are not enough for innovation, either. Communities of practice and networks of practice are rooted to the tradition of the practice, and so might be quite conservative. To enforce access to new, complementary knowledge different kinds of networks must build. They might be called networks of innovation.

In its simplest form a network of innovation consists of a group or team of experts with different background and experiences working together in a project. The essential character of innovation network is that its every member has his own strengths and expertise. So the network is heterogeneous and in it expertise is distributed. Innovative knowledge communities are also a form of networks of innovation, especially when its members are collected from different organizational units. But in general these people are mustered for a relatively short time to identify and solve a problem or more generally to create new knowledge. Members of networks of innovation have their own formal and informal relations to their own communities of practice and "home organizations". By collaboration of these members and their own networks a network of innovation form a synergetic process, in which different knowledge pools are used to produce new knowledge (see Figure 4).

Absorptive capacity is capability to adopt in organizations the new knowledge emerging in collaboration or otherwise acquired. But other kind of capability is needed to be able to benefit

from networks of innovation. We refer here to the meta-capability to collaborate. Collaboration is a process whereby two or more parties work with each other to achieve mutually beneficial outcomes (see Miles et al. 2005). According to Raymond Miles the crucial meta-capabilities for successful collaboration are trust between parties and intrinsic motivations of parties. Without trust partners could not be open enough to share their ideas and knowledge. By intrinsic motivations Miles and his colleagues refer to seeing interaction satisfying in itself without concern for the ultimate or immediate outcome.

Inter-firm learning – a case study

One case study on inter-firm learning is presented by Yli-Renko et al. (2001). They studied the effects of social capital on knowledge acquisitions and knowledge exploitation in key customer relationships of young technology-based forms. They considered three aspects of social capital in those relationships: the level of social interaction between firms, the quality of the relationship in terms of goodwill trust and reciprocity, and the level of network ties created through the relationship. As effects of cooperation they counted greater new product development, enhanced technological distinctiveness, and reduced sales costs.

Based on the survey data from 180 firms in five high-technology sectors in the United Kingdom, they found that:

- Social interaction and network ties are positively related to knowledge acquisition, but that relationship quality is negatively related to knowledge acquisition.

- Knowledge acquisition is positively related to new product development, technology distinctiveness, and sales cost efficiency.

- Key customer relationships offer significant learning opportunities for young technology based firms.

Note that the relationship quality refers to the extent that social interaction between firms is marked by the development of goodwill trust and expectations of reciprocity. As explanations of the above negative correlation between quality and knowledge acquisition are that key customer relationships may suffer from “overembeddedness” or that great trust leads diminishing monitoring of the interaction (see Yli-Renko et al. 2001). Maybe that high-quality trust diminishes the need to internalize the knowledge of partners. This phenomenon is also economically reasonable, because internalization and monitoring are might be waste, so that trust helps organizations to save.

We can conclude that a governance mechanism is needed to monitor the inter-firm learning (see Mohr&Sengupta 2002). The task of the restriction of overembeddedness is twofold. On the one hand governance helps to maximize the “positive” potential of inter-firm learning and on the other hand it helps to limit possible risks of co-operation. By risks Mohr and Sengupta refer to potential leakage of valuable information and even strategic know-how, resulting in the potential dilution of competitive advantages. They develop a framework for the role of governance in regulating knowledge transfer. Their model contains a pattern of governance mechanisms fitted to the ex ante conditions of inter-action and learning: type of knowledge the focal firm seeks, learning intent of the partner firm, and the duration that the partners have in mind for the alliance. Types of knowledge they considered, are explicit and tacit. I’m not going into details of their model, but see Mohr&Sengupta 2002.

Industry-academy networks

I introduced above the concept of deep explicit knowledge in order to stress the central role of scientific research and theories in knowledge economy. There are several ways the scientific knowledge has an effect on the growth of economy and competitiveness of firms (see Lee&Walshok 2003 and Geiger 2004).

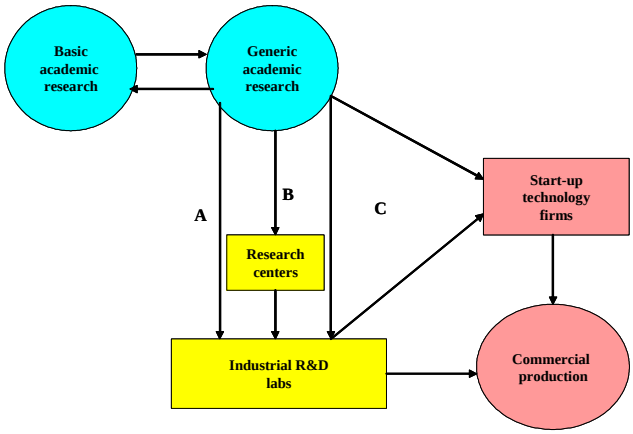

Figure 4. Pathways form academic research to industrial production (Geiger 2004, Fig. 15)

The pathways from academic research to industrial production are analyzed by Geiger in the following way (Geiger 2004, 202-207, see Figure 4). The pathway A is the traditional research relationship between universities and firms (contract research or research co-operation). The pathway B represents the public subsidization of technology development (public, non-profit research centers). The pathway C represents creative local infrastructure, like the one in Silicon Valley ecosystem. New technology-based firms perform the same intermediate function as industrial labs at established firms in developing new technologies. Such firms emerge form industrial labs as spin-offs, but also from universities by academic entrepreneurs. In any case, there is a close co-operation between industry and university and, at least, good sense of what is new in science and technologies. There is affinity between university and industrial actors and a resulting reciprocity in their exchanges. The change of ideas and the transfer of knowledge are enhanced by research parks and business incubators.

In biotechnology, the interaction between universities and firms is more intimate than in other technologies like IT. According to Geiger, in “biocapitalism” the knowledge transferred from universities to industry takes the form of intellectual property. Note that knowledge in biotechnology has turned to be economically valuable and it can be patented. The knowledge is patented or licensed to an established or a start-up company. The development of technology continues in firms, partly accompanied by active participation of researchers from universities (see Figure 5).

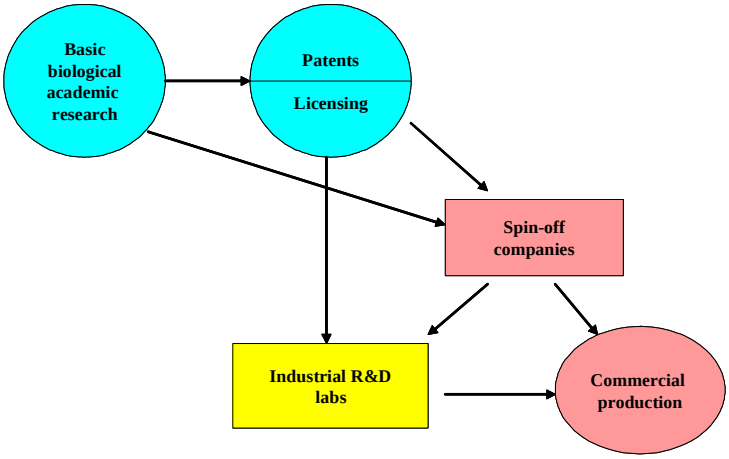

Figure 5. Biotechnology: Pathways from academic research to industrial production (Geiger 2004, Fig. 16)

Weak local ties and ecosystems

Networks of learning presented above are based mainly on dyadic close co-operation between firms with divergent or complementary knowledge (producers-suppliers-customers). On the other hand, networks of practice are based on stronger or looser connections between people sharing the similar practice. But there are also other kinds of networks relevant to learning. Especially important are clusters. It's a common wisdom that locality helps knowledge acquisition and this is one reason for clustering.

It is not a new phenomenon that companies in the same or related industries cluster in the same regions. Firms form local agglomerations, which effect competition. According to Porter the benefits of clustering are (Porter 1998):

1. Clusters increase the firms' productivity.
2. They help drive the direction and pace of innovation.
3. They simulate the formation of new businesses.

In general we can say that mobile resources tend to agglomerate because proximity provides several benefits not achieved by distance. The agglomeration concerns people as well as firms. Creativity attracts creativity.

Porter's cluster analysis does not completely explain the dynamics and evolution of innovation environments. A more dynamic approach is to apply the concept of ecosystem borrowed from biology to evolutionary economics. In ecosystems elements (like firms) are interacting and interconnected (see Hautamäki 2006). There is cooperation and competition between them. The ecosystem is a complex, self-regulating dynamic system without centralized decision-making.

Silicon Valley is an illuminating example that helps us to understand the meaning of ecosystem to the innovation economy. There are five main constituents in the Silicon Valley ecosystem according to Bahrami and Evans (2000):

1. Research institutes and universities for producing new knowledge, technologies and skilled workers
2. Venture capitalists for funding start-ups and rapid growth of firms
3. Sophisticated service infrastructure allowing start-ups to focus on their core competencies (contract manufacturers, accounting firms, law firms, design firms etc.)
4. Diverse talent pool of professionals from all over the globe
5. The pioneering spirit and relentless work ethic which encourage taking risks and going to new fields and businesses

What makes this system work and produce innovation is networking and recycling of people. The Silicon Valley ecosystem functions through an interconnected network of personal relationships, write Bahrami and Evans. The labor force is very flexible and professionals' mobility is highly rated. People are used to changing jobs often and crossing the borders of industries and universities. This movement circulates ideas and knowledge in the entire region. Most networking is informal and takes place at restaurants, parties and leisure organizations (agoras). In virtual world agoras are based on web communication by Internet (NetGoras**)**.

One important argument for agglomeration of firms and the benefit of proximity is based on the nature of knowledge creation. Tacit knowledge always has a local character. Firms which operate in the same regions have direct or indirect access to the same knowledge base, including tacit knowledge.

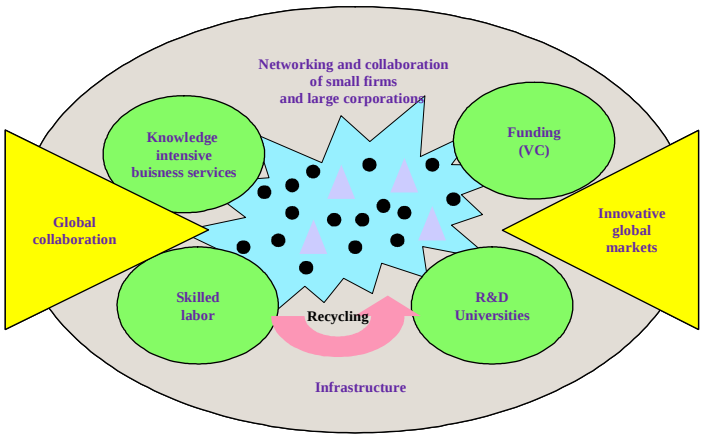

Figure 6. The elements of innovation ecosystem

Informal networking, face-to-face interaction, and recycling form the basis of the dynamics of the ecosystem. But what makes this kind of ecosystem productive is the "life of firms". The ecosystem is a huge experiment in which best ideas and technologies are

tested by the success and failure of firms. AnnaLee Saxenian writes that, “the high rate of failure as well as of new formation is a crucial source of collective learning in Silicon Valley” (Saxenian 2006, 34). Even more, in a rich ecosystem there are markets for highly specialized firms, which provide services, components and subsystems needed by other firms. Final products emerge in the collaboration between these specialized firms. So the production system is decentralized and fragmented, like in biological ecosystems. (See the Figure 6 for elements of the innovation ecosystem.)

One important aspect of local ecosystems and clusters is so called “local buzz”. Maskell, Bathelt and Malmberg write that the “relevant buzz consists of a continuous flow of updated information of specific interest for local industry, together with a multitude of interpretations and informed suggestions on how to transform any new turn of events into something commercially viable” (Maskell et al 2005a). Firms in an ecosystem are surrounded by a tight web of gossip, opinions, recommendations, judgments and interpretations. Free access to local buzz is guaranteed by just being there. So buzz accelerates information sharing and knowledge creation in ecosystems. It’s a kind of local spillover or externality that companies can utilize (see Johnsen 2006). Of course, firm’s ability to benefit form local buzz is dependent on their absorptive and dynamic capabilities as emphasize by Teece among others – just hanging out is not enough.

Temporary clusters

The buzz effect is not dependent on permanent presence. Also fairs, exhibitions, conventions, congresses, and conferences are sources of information to business people and professionals. Here, their latest and most advantages findings, inventions and products are on display to be evaluated by customers and suppliers, peers and competitors. Maskell at al. refer by the notion of temporary clusters to this kind of short-lived hotspots of intense knowledge exchange, network building and idea generation (Maskell et al. 2005a).

The membership in temporary clusters forms a global pipeline for knowledge acquisition. Maskell at al. write that “temporary clusters are significant vehicles for the integration of local and global communication flows and the connection between distant pockets of knowledge in different parts of the world” (Maskell at al. 2005a). According to them temporary clusters are important for firms on the lookout for suitable partners for joint innovative efforts and knowledge creation. Also they are sites to built networks of practice among specialized experts.

Maskell at al. discuss also about inter-firm projects as temporary form of cooperation. Inter-firm projects are a typical form of production in creative industries like producing a film and in the construction industry. They are based on a deep social division of labor and strong temporary interdependencies between agents involved. The spatiality of projects is quite fluid and takes place in different places or forms temporary localities of interaction. Inter-firm projects are mainly built to perform a certain task.

Table 1. Organizational configurations of knowledge creation by time horizon and focus (Maskell et al. 2005a).

		Time horizon for knowledge creation	
		Quasi-permanent	Temporary
Focus of knowledge creation	Strong focus (goal-oriented)	Stable inter-firm networks	Inter-firm projects
	Broad/diffuse focus (vision-oriented)	Clusters	Trade fairs, conventions, professional gatherings

One useful contribution of Maskell at al. is in my mind their comparison of different organizational configurations of knowledge creation (see Table 1). They use two variables, one for time horizon for knowledge creation and the other for focus of knowledge creation. Time horizon might be (quasi-)permanent or temporary. The focus of knowledge creation might be strongly focused knowledge generation or less structured knowledge exchange processes, where unanticipated encounters and interactions can play a major role.

Open innovation and commons

Henry Chesbrough launched the concept of open innovation paradigm in his book Open innovation (2003). Open innovation means that companies should make much greater use of external ideas and technologies in their business, while letting their unused ideas be used by other companies. According to Chesbrough, open innovation offers the prospect of lower costs for innovation, faster times to markets, and the chance to share risks with others (see Chesbrough 2006). Close innovation refers to traditional vertical innovation model, where internal research and development activities lead to internally developed products that are then distributed by the firm. Open innovation paradigm treats R&D as an open system.

One natural assumption behind open innovation paradigm is that useful knowledge is widely distributed. Eric von Hippel (1988) identified four external sources of useful knowledge (see also von Hippel 2005 for the role of customers):

1. Supplier and customers
2. Universities, government, and private laboratories
3. Competitors
4. Other nations

Even the most capable R&D organizations need to be well connected to these external sources of knowledge. In global economy these external sources are distributed all over the world. From the viewpoint of firm in open innovation paradigm the question is how to identify potential valuable external ideas and how to access those ideas without compromising their own internal development activities.

Three issues could be raised in this context. One is the absorptive capacity of organizations to use external knowledge (see dynamic capabilities of firms). This capacity is partly based on internal R&D in firms (enough know how to adopt external knowledge). The second issue is ways to reach external knowledge, say by building local and global networks of firms (see above). The third aspect is related to the emergence of intermediate markets for innovation and intellectual property (IP).

In intermediate market ideas and technologies are developed by sellers and sold to buyers who take those ideas and technologies and sell them to consumers. In close model of innovation companies market their new discoveries themselves. On open model companies may for example license technologies to other companies, thus creating a secondary market for innovations.

By innovation intermediaries Chesbrough means companies or organizations which help innovators to use external ideas more rapidly or help inventors find more markets where their own ideas can be used by others to mutual benefit. These organizations owe their existence to the emerging markets for IP, and their business models are creating access to a global community of innovation providers (cf. companies like InnoCentive, InnovationXchange and Shanghai Silicon IP Exchange presented in Chesbrough 2006). In terms of network theory, these companies are innovation brokers.

To be successful in innovation intermediary business, some conditions must be fulfilled (Chesbrough 2006). One is the specification of problems need to be solved. The problems are not always well defined, especially in the case of innovation. A company looking for external knowledge or technology perhaps doesn't know what it is looking for. Brokers must be able to help company to identify problems before they could search providers of "solutions".

A core issue here is the management of IP. One observation is that IP protection (like patents) has become stronger in the past twenty-five years. Beside normal cross-licensing between firms using each others technologies there are also pure IP companies, which own intellectual properties but not use them in their own production, or they have no production.

Although, there is a tendency to strength IP protection, there is also counter movement towards "open source" production. The core of IP is the right of owner to exclude non-owners to use the property. Steven Weber writes that property in open source is configured fundamentally around the right to distribute, not the right to exclude (Weber 2004, 16). In open source production a group of networked experts participates to the production of a product (like free software) voluntarily and without payment. The major motivation for participation might be the reputation among colleagues.

From the viewpoint of economic theory IP protection is needed to motivate companies to invest in new technologies and innovations, because IP guaranties profit. Eric von Hippel use the term "private investment model of innovation" to describe this traditional economist assumption that innovation will be supported by private investment if and as innovators can make attractive profits from doing so (von Hippel 2005).

The other extreme is "collective action model of innovation" which assumes that innovators are required to relinquish control of knowledge or other assets they have developed to a project and so make them public good (non-excludability and non-rivalry, see von Hippel 2005 and Weber 2004). Normally knowledge is considered to be a public good (cf. universities). One problem in collective action model is temptation to be a free rider, who benefits form public good without contribution.

Von Hippel proposes a middle model, which he calls “private-collective model of innovation” based on two assumptions:

1. Free revealing of innovations: under common conditions free revealing of proprietary innovations may increase rather than decrease innovators’ private profit.

2. Free riders of innovations: contributors to a public good can inherently obtain greater private benefits than free riders.

Yoshai Benkler makes in his recent book The Wealth of Networks a strong argument for the emergence of a non-market, non-proprietary production. According to him the success of free software suggests that

> “the networked environment makes possible a new modality of organizing production: radically decentralized, collaborative, and nonproprietary; based on sharing resources and outputs among widely distributed, loosely connected individuals who cooperate with each other without relying on either market signals or managerial commands.” (Benkler 2006, 60).

Benkler calls this “commons-based peer production”. The salient characteristic of commons is that no single person has exclusive control over the use and disposition of any particular resource in the commons (see Benkler 2006). Taking into consideration the complexity and the economic success of open source software (Linux, Apache, Wikipedia etc.) one could argue that commons-based peer production is at least as effective to produce innovation as the traditional market-based production (see Weber 2004, von Hippel 2005, Benkler 2006).

From firms’ perspective the participation to the commons-based peer production might be hard to manage, especially the management of IP is unsettled. But interestingly enough there are some possibilities to create “bounded-commons”. Miles at al. studied in their book Collaborative Entrepreneurship the conditions for close collaboration between firms to enforce continuous innovation (Miles at al. 2005). The collaboration takes the form of collaborative multi-firm network, which is basically a broad, general purpose alliance among independent firms. Members of this kind of networks collaborate across firm lines, sharing common knowledge to create and exploit economic value through innovation.

The core is that knowledge and information sharing is broad and general purpose. This network is designed to exploit the know-how and capabilities of all of its members and to do so without constraints of central planning. In this community ideas born in one firm may be expanded and developed in a second firm and taken to market by or with a third firm. So firms in the network might have multiple roles.

Because members of the network are economically independent and suppose to develop their own businesses the competition between members might be a problem. Constraints of success are to select members so that their resources are complementary and to invest in social capital (trust). Under such condition we could imaging that a collaborative multi-firm network could create a bounded-common, a knowledge stock open to every member of network.

The table 2 summarizes concepts of “open innovation”. There are three alternatives to close innovation paradigm. The most moderate step is to start to buy external ideas and sell own ideas = open innovation. Or, firms might build a collaborative multi-firm network to develop together

new ideas and to share them = semi-public innovation. And finally, firm could start to work in a totally open environment sharing knowledge freely = public innovation. So we have four modes of innovation (see Table 2).

Table 2: Modes of innovation.

	Close innovation	Open innovation	Semi-public innovation	Public innovation
Source of innovation	Internal ideas	Internal and external ideas	Internal and joint ideas of a network	Internal and public knowledge
Access (fee)	Firm owns its ideas, Own IP	Buying and selling ideas, IP markets	Free for members, Bounded-commons	Free for all, Commons

Global knowledge transfer

In global networked economy assets are scattered all over the world. Traditional assets and processes are owned and located in the home market. Off-shored assets and processes are still owned but located in a foreign market. Outsourced assets and processes are not owned but accessed from a third party in the home or foreign markets. Firm's competitiveness relies on its ability to connect and manage all these assets and to be a part of a global innovation network.

The off-shoring activities are also related to knowledge creation and innovation. Peter Maskell et al. have shown based on studies about Danish firms that offshore sourcing in low-cast countries is best described as a learning-by-doing process in which the offshore outsourcing of a corporation goes through a sequence of stages towards sourcing for innovation (Maskell at al. 2005b). This means, among other, that innovation processes can be outsourced.

A motivation for such outsourcing of innovation is based on differentiation. In different areas of production and knowledge creation also knowledge turns to be different. Thanks of path-dependence and local conditions knowledge-base and know-how are specialized. So firms could reach a new complementary knowledge by a close cooperation with distant firms (or divisions, plants etc.). A local knowledge base is formed in local centers surrounding local ecosystems.

Of course, off-shoring of production is not the only form of knowledge transfer form distant places. Especially, acquisitions of firms from foreign markets are often motivated by access to new resources and knowledge stock.

The knowledge transfer is not an easy business, however. Local knowledge is basically tacit and the only way to "transfer" tacit knowledge is to work with people who have developed it. So learning presupposes participation to communities of practice and even to live in local ecosystem. I introduced earlier the concept diaspora to refer to a distant community with close relation to its own environment and at the same time to the main community organization.

AnnaLee Saxenian has studied the role of immigrants in Silicon Valley and in transferring know-how to their native countries. She emphasizes the importance of brain circulation.

> "Silicon Valley's foreign-born entrepreneurs, managers, and investors began to establish professional and business connections not only with local peers, but with their home country counterparts as ell. In so doing, they transformed the one-way brain drain into a complex, two-way process of 'brain circulation' and, over time, transferred the central elements of the Silicon Valley entrepreneurial system to distant regions." (Saxenian 2006, 83).

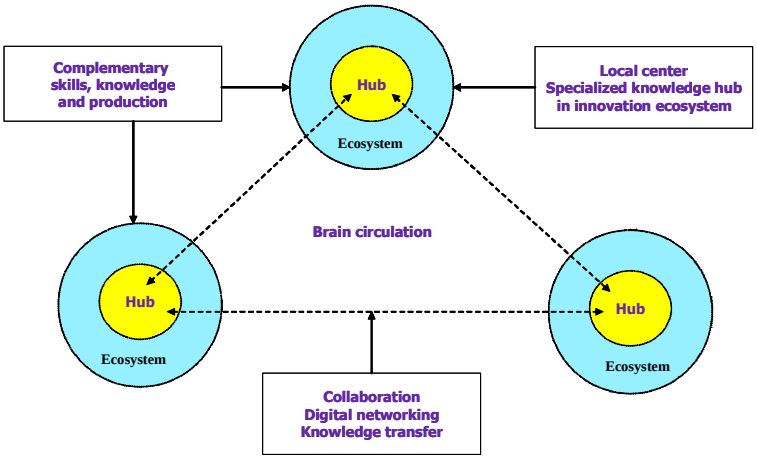

Figure 7. Knowledge transfer between knowledge hubs, emerging of cross-regional communities

Information technology is now providing effective tools (Internet, social webs, "web 2.0 etc.) for global collaboration. These tools make possible to search information from huge number of web sites all over the world. Even more, a new kind of collaborative production and global innovation are emerging. The structures of industries are changing and industries are more and more operating by collaborative principles like openness, peering, sharing, and acting globally (see Benkler 2006 and Tapscott&Williams 2007).

As a result of close cooperation, joint problem solving, and brain circulation a cross-regional technical community is emerging that allows distant producers to specialize and collaborate to upgrade their capabilities (see the Figure 7).

Conclusions: classification of innovation networks

We have seen that there is a variety of ways to acquire knowledge. We have also seen that the proper concept of knowledge is ambiguous. In order to reach a full body notion of knowledge creation, it is needed a taxonomy of different types of knowledge and ways to acquire knowledge. At best we will have a model for knowledge creation in global networked economy. But the taxonomy is the first step towards such a model.

The basic taxonomy of knowledge is based on two distinctions:

- explicit knowledge vs. tacit knowledge
- knowledge vs. information

In fact, behind tacit knowledge there is the deeper distinction between indwelling tacit knowledge, which is impossible to express directly in language, and implicit tacit knowledge, which could be express in explicit form by focusing on it. The real reason to handle tacit knowledge in this context is that important part of all knowledge needed in firms and in innovation is tacit and learned by doing. The concept of community of practice denotes exactly to groups of people sharing a common practice. So basically, one can learn tacit knowledge by working in a community of practice. Tacit knowledge has a local and contextual character. But note that explicit knowledge is the basic form of knowledge, because only explicit knowledge could be communicated and cumulated. Especially important form of explicit knowledge is deep explicit knowledge which consists of complex scientific knowledge, like theories and models.

Information is defined above as codified knowledge and it exists in literary or symbolic forms (in books, in data files etc.). Knowing is an act of human beings. Knowledge is always knowledge of somebody: a subject of knowing is needed. Knower could interpret and understand the information, in his own way, of course.

Knowledge creation is a process to acquire new knowledge by developing practices and by combining different knowledge. It is at the same time a deepening process and broadening process. In deepening process people are developing their expertise (know how) and in broadening process community is adapting and absorbing new knowledge from some external sources. Often, new “outer” knowledge is transmitted in the form of information, sometimes in the form of learning by doing.

Innovations are introducing something new and useful (a now product, service, process, organization, channel, model etc.). Often innovations are incremental, just providing better quality and performance. Sometimes there are radical or disruptive, offering new technologies and creating new markets. These are different types of innovation. Open innovation is related, on the other hand, to ways to produce innovation in collaboration using external ideas. So the notions of close and open innovations, or public innovation are network concepts too (inside, outside, shared). These are different modes of innovation.

From the viewpoint of innovation the role of external knowledge acquisition is decisive because innovation is “new combination of resources”. In fact, resources like knowledge, skills, talents etc. are distributed all over the world and global economy opens access to them. So a problem is how to find the right complementary resources firms need to make innovation = search problem. Another problem is the ability of firms to incorporate new resources into their own resources (dynamic and absorptive capabilities) = absorption problem. Innovation networks (exploration and exploitation networks) must provide solutions to both search and absorption problems.

Table 3. Properties of learning networks.

Network dimensions	**Exploration networks**	**Exploitation networks)**
Organizational learning	Exploration new possibilities	Exploitation of old certainties
Target of networking	Access to new information and possible partners for cooperation	Improving capabilities and sharing knowledge between partners
Type of knowledge	Information and explicit knowledge	Tacit and explicit knowledge
Links	Weak ties	Strong ties
Bridging	Mediated	Direct
(Local) Social structure	Clusters, ecosystems	Communities or inter-organizational relations
Social capital (SC)	Building, accumulating SC	Using, consuming SC
IT-channels Internet	Used for searching and sharing information	Used for (distant) cooperation and knowledge sharing
Formality of relations	Informal	Formal and informal
Time horizon	Temporary	(Quasi)-permanent
Fitness of knowledge	Complementarily	Good fitting and similarity
Stickiness of knowledge	Leaky	Sticky
Problem solving	Identifying problems	Solving problems
Learning	By “listening”, “buzz”	By doing
Type of innovation	Radical and disruptive innovation	Incremental innovation Sustaining innovation
Mode of innovation	Open or public innovation User innovations	Close innovation Semi-public innovation

In my summary I make a tentative distinction between search networks and absorption networks. The target of search networks is have better access to new information and explicit knowledge. Networks of absorption are mainly devoted to improve capabilities and deepening the tacit knowledge pool of organizations. The dimensions of learning networks are presented in the Table 3. Note that differences between search and absorption networks are not so sharp than expressed on the table. Absorption networks are at the same time searching networks: benefit from good social capital say in networks of practice. Searching networks are used also for adoption (tacit) knowledge say by participation on conferences.

In fact there are several networks of learning. It’s clear that a firm can’t manage all of them. The search of knowledge costs always something, sometimes more (like off-shoring or acquisition of firms) sometimes less (participation to a conference). The proximity argument is based on externalities of tight relations of firms: leaking of information. To acquire new knowledge firms must invest on search networks and cooperation.

We have six generic types of networks: Agora, Alliance, Diaspora, Fair, Guild and Netgora (see Table 4). In all links are different. Three first of these types presuppose face-to-face communication. Netgora is a web-based, “virtual” type of networks. Links in alliances and guilds are strong, whereas links in Agora and Netgora are weak. Links in alliances are formal, but in all

other networks links are informal. All four types are ideal types of innovation networks: in reality these types are mixed and overlapping.

- **Agora**: a public place and space for meeting and changing ideas and information (Orig. a popular assembly for political or other purposes; a market place.).
- **Alliance**: a formal treaty or agreement between parties, an intimate relation, for collaboration and cocreation of knowledge.
- **Diaspora**: a distant community with close relations to its own environment and to the main community or headquarters (Orig. the dispersion of the Jews among the Gentiles after the Babylon exile).
- **Fair**: an exhibition, a gathering of buyers and sellers of ideas and knowledge. (Orig. an occasion or periodical exhibit, a steady or regular market; also "mess")
- **Guild**: a local community of people with mutual interest, dependences, and activities. (Orig. a corporation or association of persons engaged on kindred pursuit for mutual protection, aid etc.). Often guilds are professional clubs and use to keep monthly or annual meetings.
- **NetGora**: A web based site for sharing information about things generally interesting or about a specific topic; open or closed site. Called ideagoras by Tapscott and Williams (2007).

Table 4. Types of innovation networks.

Type of network	Guild	Alliance	Agora	Netgora
Characteristics	Professional community, club, union etc.	collaboration between firms (and with research organizations)	Local public space Local buzz	A virtual space to share information and to collaborate
Type of connections, links	Strong, mainly informal	Strong, mainly formal	Weak, informal, face-to-face	Weak, informal Virtual
Knowledge sharing	Tacit knowledge, Expert knowledge	Explicit knowledge	Information	Information

By combining these types to the concept of diaspora we get a diaspora-model for innovation networks (see Figure 8). It's a good summary of all basic concepts presented in this article. In diaspora-model diaspora is connected to surrounded local ecosystem by many kinds of networks: alliances, guilds and agoras. It's connected to main organization by formal ties, but knowledge transfer is realized by brain circulation and web: netgora.

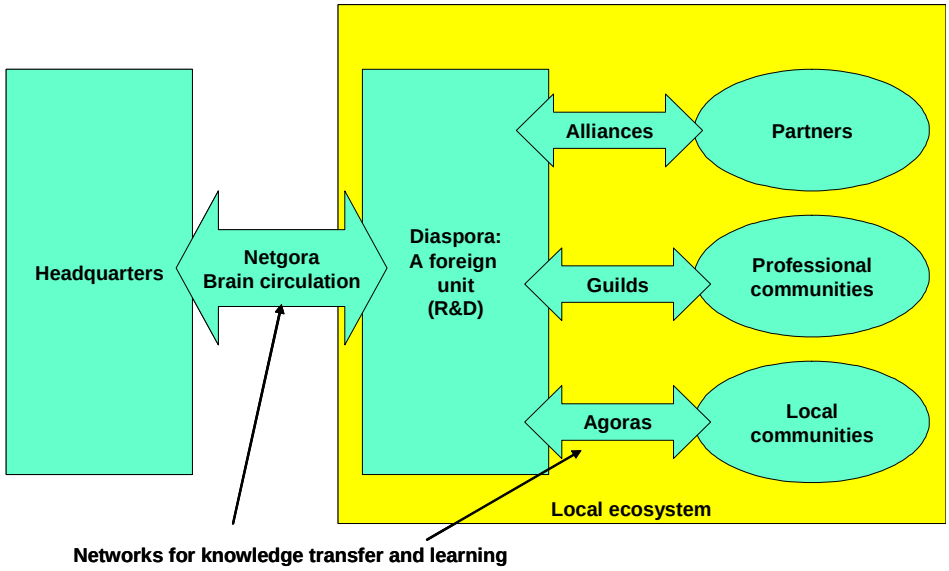

Figure 8. Diaspora-model of knowledge transfer

Towards a model for Multi-Channel Innovation Networks

The analysis presented in this article provides theoretical standpoints to build a model for searching knowledge. It's natural to call it Multi-Channel Innovation Networks Model (MuCIN-Model), because it opens to firms a menu of several channels for knowledge acquisition and creation. Different channels are optimal for different tasks concerning cooperation, knowledge creation and innovation. Some channels are not affordable for some firms, because of resources, path dependency, dynamic capabilities, and location. To elaborate a sound multi-channel knowledge learning model empirical studies are needed. Network theories must be applied to deepen the classification of learning networks. Theories of firm management are important to understand firms' absorptive capabilities to adopt new knowledge and turn it to the proper resources of the firms. For each channel a cost-benefit analysis must be possible to conduct related to different industries and types of firms. It's important also learn to measure the impacts of social capital to costs of knowledge searching.

The MuCIN-model consists of a) creation of search strategy based on firm's basic innovation strategy and capabilities, and b) execution of the strategy in innovation processes (networking, knowledge creation and product development) (see Figure 8). The MuCIN-model must include also feedback (learning) loop from production and sale to guarantee flexibility and continuous adjustment of innovation strategy of firms.

My starting point was to analyze the very concept of knowledge. The popular concept of tacit knowledge originates from the long philosophical tradition, from Aristotle's practical knowledge to American pragmatism to phenomenology to Ryle's treatment of know-how and finally to Polanyi's tacit dimension of knowledge. Without an accurate concept of knowledge and a proper treatment of issues related to knowledge acquisition no valid theory of knowledge creation and innovation could be developed (cf. Hautamäki forthcoming).

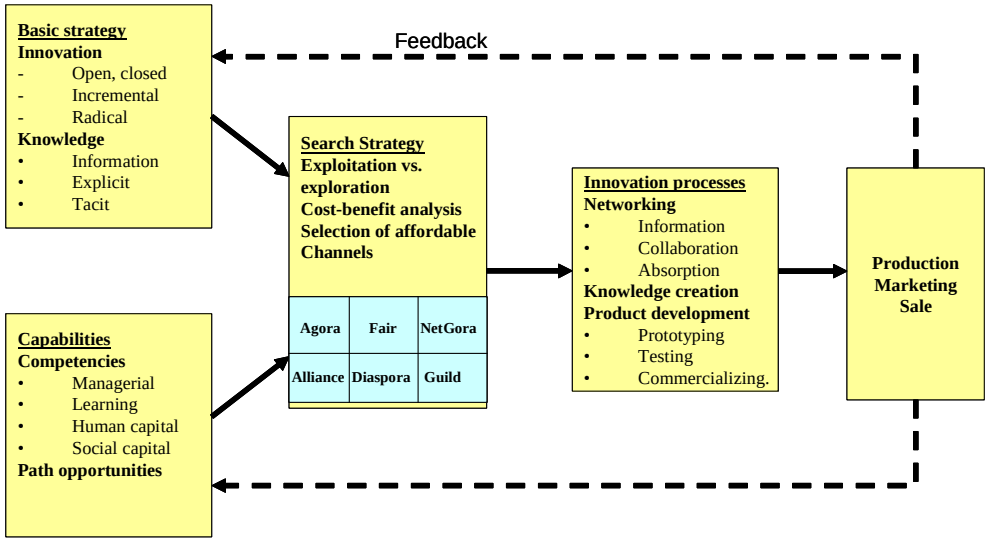

Figure 8. The basic elements of Multi-Channel Innovation Networks Model

The tentative Multi-Channel Innovation Networks Model presented here will work as a heuristic model for understanding the challenges of the knowledge and innovation creation in global networked economy. The competitive advantages of firms in the era of global value chains are dependent on firms' ability to manage the whole menu of channels for innovation. MuCIN-model might be one tool to analyze and develop such capability.

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