Paper to be presented at the 46th Congress of the European Regional Science Association
August 30th – September 3rd, 2006. Volos, Greece

Absorptive capacity in practice-based innovation activities: Case of Lahti Region in Finland

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Abstract

As a consequence of agglomeration economies, for example, features such as a good reputation and a highly-skilled labour force tend to accumulate in university regions. The accumulation of highly-skilled labour and high research intensity secure a continuous flow of "raw material" for innovations in the knowledge-based economy. However, in regions lacking a university it is vitally important to find other ways of increasing innovation activity.

Through implementation of non-linear innovation activity combining knowledge of normal practice-based activities and science-based research, a region can create radically new operating perspectives. The new theories of innovation suggest that there is a great potential for innovation in the structural holes and weak links of the innovation system. The new sources of innovation place demands on the innovating partners. In order to exploit the hidden potential in the innovation system, the regional actors must possess, for example, high absorptive capacity, tolerance for diversification and, in particular, the bridging elements of social capital.

The Lahti Region in Finland is one of the regions lacking a strong regional research base. Determined to create a new source of competitive advantage, the Lahti Region is heading towards a vision of being a leading region in promoting practice-based innovation activities. Therefore, the region has created a new policy framework to achieve the vision: network-facilitating innovation policy. The policy aims to promote networked innovation processes especially by exploiting the potential of the structural holes of the innovation system and linking the research-based knowledge from neighbouring strong research centres in the regional innovation processes.

This paper examines the readiness of the regional actors to face the demands of the new policy framework. Particular focus is on the questions of absorptive capacity and information brokerage in the regional innovation system. A survey study among representatives of companies, educational and research organisations as well as public organisations formed the empirical data used.

Introduction

Innovation was earlier seen as a radical invention accomplished by a heroic inventor. However, the current theories of innovation emphasise its nature as the result of co-operation in normal social and economic activities (Kline and Rosenberg, 1986; Lundvall, 1988). The innovation process normally includes many kinds of interaction, and innovations do not have to be radical, on the contrary, they are incremental social and organisational changes as well as technological advancements. Consequently, innovations are not just the results of scientific work in a laboratory-like environment. They take place in networks, where actors of different backgrounds are involved in the process placing new demands on innovativeness. The science push effect as the driving force of innovations is an exception rather than a rule in these processes (Schienstock and Hämäläinen, 2001). Rather, innovations seem to presume factors like ability to interact learn collectively and build trusting relations between the innovating partners (Harmaakorpi, 2004). Innovativeness depends on the innovation network functioning rather than on an individual actor's progress in a particular scientific field.

Characterising innovation as a socially and economically embedded process raises the question of the socio-institutional environment in which the innovation processes take place. In a regional context, innovation is seen as a process embedded in a regional innovation system (see, e.g., Cooke *et al.,* 1997; Storper, 1997; Braczyk *et al*., 1998; de la Mothe *et al*., 1998; Doloreux, 2002). A regional innovation system is understood as a system of innovation networks located within a certain geographic area, in which firms and other organisations are systematically engaged in interactive and collective learning through an institutional milieu characterised by embeddedness (cf. Cooke *et al.*, 1998; Kostiainen, 2002). A regional innovation system consists of different kinds of multi-actor innovation networks including actors with often very different aims and knowledge interests. Moreover, these networks normally lack clear leadership, being actually led by a shared network leadership (Harmaakorpi, 2004).

A regional innovation system consists of innovative networks with various social relationships. Social structure, especially in the form of social networks, affects economic outcomes, since the networks affect the flow and quality of the information (Granovetter, 2005). Granovetter (1973) defines the concepts of strong ties and weak ties in social networks. The strength of a tie is a combination of the amount of time, the emotional intensity, the intimacy and the reciprocal services that characterise the tie (Granovetter, 1973). Strong ties are characterised by common norms and high network density. These strong ties are easier for innovation activities, since they normally include a relatively high amount of trust, common aims and the same kind of language to communicate. However, the weak ties are reported to be more fruitful for innovations, because more novel information flows to the individuals through weak ties than through strong ties (Granovetter, 2005). People in the same strong networks tend to share the same knowledge basis preventing the Schumpeterian knowledge-combining innovation processes from emerging (see Schumpeter, 1942). Burt (1992) has developed the "strength of weak ties" argument further by arguing that innovations are most likely found in the structural holes between the dense network structures (see also Burt, 2004; Walker *et al*., 1997; Zaheer and Bell, 2005). An actor able to span the structural holes in a social structure is at "a higher risk" of having good ideas: the new ideas emerge from selection and synthesis across the structural holes between groups (Burt, 2004). A regional innovation system rich in structural holes offers a high level of opportunities for new networked innovation processes.

However, the weak links or structural holes enabling the biggest innovation potential are somewhat problematic. In order to be able to utilise the innovation potential in these structural holes, information should often be transferred between very research-oriented and practice-oriented partners, as well as partners of completely different horizontal knowledge interests (interdisciplinarity). Autio (1998: 133–134) defines two subsystems in regional innovation systems: (i) a knowledge generation and diffusion sub-system and (ii) a knowledge application and exploitation sub-system. The potential innovating

partners in different sub-systems might not be able to even begin the processes because of a lack of common rules for communication. Even in the same technological field, the language in basic research is so different from practice-based innovation processes that an innovation process could end before it has started, even if the innovation potential in the structural hole is obvious. The situation is the same between different technological disciplines. The situation is most complicated when there is a desire to span the structural hole between a partner with a research-oriented knowledge interest in one technological field and a partner with a practice-oriented knowledge interest in another.

Hayek (1945) claims that science combines all existing knowledge but says also that there is knowledge that is tied to a place, time or people and cannot in that case be called scientific. So the greatest result is achieved by combining this contextual knowledge with scientific knowledge (Foray 2004, 56). The main focus here is on non-linear innovations born from user needs and brought to the process of scientific research. The innovation processes are thus created by many triggers and take place in the networked multi-actor innovation networks. These processes often occur in a practical context.

In such practice-based processes there is a strong need to combine knowledge interests from theory and practice, as well as knowledge from different disciplines. The traditional model of developing novel knowledge based on existing theories gives a completely insufficient methodological approach in this current environment. Also a new kind of characterisation for expertise is needed. The experts in the innovation processes cannot just pour knowledge into the innovating partners and then disappear; they have to be interactive partners in the collective learning processes leading to successful innovations.

The innovation policies have, however, traditionally been largely equivalent to the science and technology policies emphasising the science push effect in creating innovations. The effectiveness of the reigning waterfall model (basic research – applied research – development) can however be strongly questioned. For example, Finland is among the three best countries in the world in research inputs leading to only about the 15th place in living standards. The national innovation system does not produce the results expected from the research inputs. Schienstock and Hämäläinen (2001) suggest that a system approach-based, network-facilitating innovation policy is the modern way to enhance the innovation environment (see also Harmaakorpi, 2004). The network-facilitating innovation policy pays particular attention to the dialogue between the co-operators. The dialogue aims at tackling the whole problem in the innovation system. The system approach is not only a tool for studying innovation processes, but also a conceptual framework for innovation policies and strategies (Edguist, 1997: 16). The system approach recognises that different parts of the innovation process may become bottlenecks in the successful development of new products and processes leading to many kinds of systemic failures (Schienstock and Hämäläinen, 2001; Lundvall and Borrás, 1999). All such failures are potential targets of regional innovation policies and strategies (OECD, 1998).

Regional innovation policies should, therefore, take new practical forms. If they rely mainly on an increasing scientific knowledge-base much of the regional innovation potential remains untouched. The network-facilitating innovation policy aims to solve this problem by placing the process of the formation of institutional settings enhancing collective learning, social cohesion, co-operative activities and visionary processes at the centre. According to this view, regional innovation policy is governance rather than government; its role being the facilitator’s rather than the governor's role. Accordingly, the policy measures used should target the soft factors of competition (e.g. identity, culture, institutions), as well as the hard factors (e.g. relative wages or tax levels) (Boschma, 2003; Storper, 1997).

Network-facilitating Innovation Policy

Knowledge is said to be the most important production factor, and learning to be the most important process in modern society (Lundvall and Johnson, 1994). In network-facilitating innovation policy, an interactive and collective way to learn is emphasised (Harmaakorpi and Melkas, 2004). Collective learning is a process of dynamic and cumulative knowledge creation that has, due to its interactive character, numerous synergy advantages (Camagni, 1995). Synergy advantages in the innovation networks emerge, when knowledge is transferred from one expert to another, and trust is built in the collective learning process. This process based on intensive sharing creates new knowledge and innovations. Learning and knowledge creation are too important questions to be left to occur spontaneously. According to Nonaka and Reinmöller (1998), in order to design knowledge-creating areas, all the processes by which knowledge is converted need to be supported within the region. Therefore, special attention should be directed at knowledge management at the regional level. Nonaka and Reinmöller (1998: 421) claim that "industrial regions can provide the necessary explicit knowledge and tacit knowledge through collocation". With regard to practical arrangements, they note that "physical proximity can guarantee frequently scheduled meetings, where face-to-face communication enhances the sharing of tacit knowledge" (Nonaka and Reinmöller, 1998: 415). Nonaka and his colleagues in their SECI model focus on the creation of tacit and explicit knowledge and on the interaction between explicit and tacit knowledge in collective learning (see Nonaka and Takeuchi, 1995; Nonaka and Konno, 1998. Kostiainen (2001) has applied the model in a regional context. Harmaakorpi and Melkas (2005) have developed the model further considering knowledge creation and management in regional innovation networks including the future-oriented self-transcending knowledge in their rye-bread model.

In the network-facilitating innovation policy, social capital is a central factor in promoting innovativeness (Tura and Harmaakorpi, 2005; on different views on social capital, see e.g. Nahapiet and Goshal, 1998; Adler and Kwon, 2000). According to Portes (1998) "whereas the economic capital is in people's bank accounts and human capital is in their heads, social capital inheres in the structure of their relationships". Social capital cannot be traded, but is in practice created only because of constant co-operation. The importance of social capital in creating regional competitiveness is related to the fact that it cannot be copied or transferred from one regional innovation system to another. However, it can easily be destroyed because of the bottlenecks and problems existing in the network. Two very useful concepts describing the different types of social capital needed in regional innovation systems are bonding social capital and bridging social capital. Bridging social capital creates bonds of connectedness that are formed across diverse horizontal groups (weak ties), whereas bonding capital connects only the members of homogeneous groups (strong ties) (Granovetter, 1985; Putnam, 1995).

This division of social capital into bridging and bonding types becomes crucial in assessing regional innovativeness, since it is essential both to build an atmosphere of trust in each innovation network and to keep them open in order to allow the necessary flows of information to take place. Although bonding social capital can be seen as partly fruitful for the functioning of one innovation network, the regional innovation system, formed characteristically of networks of strong bonding social capital, might lead to unwanted results, whilst the closeness of an innovation network harms both the network itself (by decreasing its absorptive capability) and the entire innovation system, since closed networks may act against the interests of other networks leading to rent-seeking behaviour reducing the aggregate economic performance (Olson, 1982). Bridging social capital is seen as positive due to its nature in bringing the individual innovation networks into trustworthy interaction enabling, for example, the increase of absorptive capacity benefits of the structural holes of these networks. Burt's (2004) definition of "social capital of brokerage" is very similar to bridging social capital.

An essential source of innovation and thus also a prerequisite for network-facilitating innovation policy is *creativity*. Eliminating the obstacles to creativity is one of the vital elements in maintaining the innovative capability. Society is overflowing with creativity-stifling factors against which an enriching dialogue within an innovative milieu may act (Bohm and Peat, 1992; Himanen, 2004). The regional innovation

system should thus include sufficient openness and creative tension: one should also be able to express dissenting opinions and critical comments in the networks (Sotarauta and Mustikkamäki, 2001). Promoting creativity and especially collective creativity in the practice-based multi-actor innovation processes is not an easy task. Successful implementation of such processes requires a new kind of methodology to enhance collective creativity and trigger collective creative eruptions (see more Harmaakorpi & Mutanen,manuscript ; Parjanen *et al.*, manuscript)

Significant innovations are often born through coincidence. Sotarauta and Mustikkamäki (2001) claim that growth centres grow because they have interfaces for coincidences. Complexity is said to nourish innovations. In a network-facilitating innovation policy the aim is therefore to find innovations in the middle-ground of different technologies and industries (see Johansson, 2004), in other words, to give coincidence a chance in sometimes very unorthodox combinations. In this context, an innovation system can be compared to a road network: just as the number of accidents grows as the traffic gets denser, so innovativeness also increases as the traffic gets denser in the innovation system. No one can surely say where and when the accidents and innovations will happen, but it is certain that they increase when the traffic gets more intense. To increase this coincidence-enabling traffic is the special task of the network-facilitating innovation policy.

The structures and routines of the education and research system need to change in order to meet the demands of the network-facilitating innovation policy. The universities still, in practice, rely very much on the waterfall model lacking adequate methods to support practice-based innovation. The change is needed in the structures and research methodologies (Harmaakorpi and Mutanen, manuscript). There is also need for a new kind of expertise in research circles. Fostering dialogue and co-operative methods must be emphasised in order to span the middle-ground between research-based and practice-based knowledge, as well as knowledge interests between different fields of knowledge.

In order to be successful a network-facilitating innovation policy:

- uses unconventional tools to trigger practice-based multi-actor innovation processes and to break the traditional basic research – applied research – development –chain
- creates systematic tools for enabling and promoting the cross-boundary (cross-institutional, cross-sectoral, cross-regional etc.) innovation processes
- organises new knowledge transfer mechanisms between practice-based innovation activities and knowledge producers
- promotes coordinated knowledge creation and management in the evolved multi-actor innovation networks including conversations between explicit, tacit and self-transcending knowledge
- promotes the right kind of amalgam of bridging and bonding social capital in the regional innovation system to increase trust in the networks but avoid unnecessary lock-ins
- enhances collective creative eruptions in the multi-actor innovation networks by using unconventional creativity methods
- creates opportunities and interfaces for coincidences
- reforms the research and education policy in order facilitate practice-based innovation activities (including a new kind of practice-based research)

Absorptive Capacity in a Regional Innovation System

One crucial subject was still missing in the previous list tackling the important features of network-facilitating innovation policy: a highly important factor in the performance of a regional innovation system is the absorptive capacity of its actors, its networks and the entire system. Originally, Cohen and Levinthal (1990) defined the absorptive capacity of an organisation to be the ability to evaluate, assimilate and apply new knowledge. Kim (1998) argues that absorptive capacity requires learning capability and develops problem-solving skills; learning capability is the capacity to assimilate the knowledge for imitation and problem-solving skills to create new knowledge for innovation. Moreover, Zahra and George (2002) define two different types of absorptive capacity giving a good point of departure for this study: potential absorptive capacity (important in acquiring and assimilating external knowledge), and realised absorptive capacity (referring to the functions of transformation and exploitation of the gathered knowledge). Both are, naturally, important in regional innovation processes: potential absorptive capacity enables the exploration of knowledge (often) over the weak ties of the innovation system, and realised absorptive capacity secures the exploitation (often) in the strong ties of the networks. The idea of potential and realised absorptive capacity in regional innovation system is depicted in Figure 1.

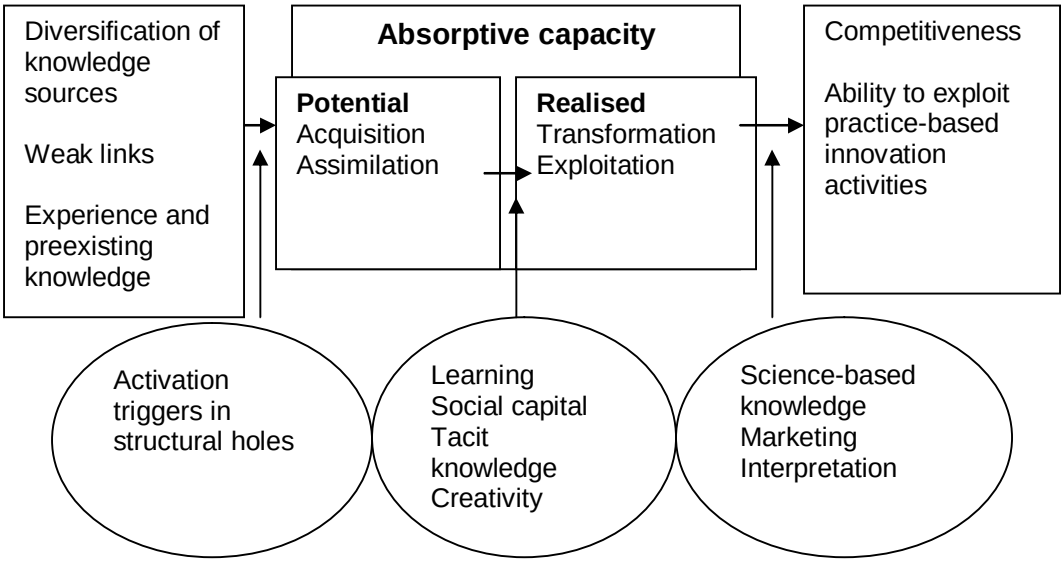

Figure 1: Absorptive capacity in practice-based innovation activities (Derived from Zahra and George, 2002)

A region has certain knowledge supplies which consist of experience. Activation triggers (Zahra and George, 2002), brokers (Burt, 2004) or intelligent agents (Foray, 2004: 111) will try to merge new knowledge from various sources into this knowledge. To obtain new knowledge, a region must possess enough absorptive capacity: potential absorptive capacity to be able to acquire and assimilate knowledge and realised absorptive capacity to transform new knowledge into one's purposes and exploit the new combination.

According to Cohen and Levinthal (1990) an organisations' absorptive capacity depends on the gatekeepers of the organisation. Those individuals interacting to and from the organisation can either proceed or delay the absorption of knowledge. At a regional level mediator organisations can be considered as the gatekeepers of a region. They can strengthen the transfer of knowledge between organisations inside region and absorb new outer-area knowledge to bring it to companies. Or if malfunctioning, just "be" resource-eating organisations without a clear vision.

Activation triggers in the position of the structural holes of two or more networks possess preexisting knowledge and experience from their own network. They also must be aware of the state of the present

and view of the future and enough weak links to other fields and business areas. Because activation triggers collide more often with controversial knowledge than others, they must be more able in some things than the others. Mediator organisations function as activation triggers in structural holes: They have practical experience and knowledge of the current state of the region, but they also actively seek weak links. Outer-area links are important especially for a non-university region. While otherwise difficult to obtain inside an area, new knowledge can be generated with the help of outer-area links (de la Mothe and Paquet, 1998). Mediator organisations' role as transferors of knowledge are here essential (Niinikoski *et al*., 2005; Smedlund *et al.*, 2005: 28), but it is also very challenging, since they need to understand the processed substance knowledge, as well as have the social abilities to work in very diverse groups. The inter-mediators need to be able, for example, to i) make the people on both sides of the structural hole become aware of the interests and difficulties of the other group, ii) transfer the best practices between the groups, iii) draw analogies between groups ostensibly irrelevant to one another and iv) synthesise the knowledge interests (Burt, 2004). In order to be able to increase the absorptive capacity of the regional innovation system, the information brokerage function is crucial: as mentioned the role of the mediator organisations is important. But the actual innovating partners should also be able to broker information.

The Case Study: Absorptive capacity in the Lahti Region, Finland

Description of the Region

The Lahti Region is the fifth largest urban region in Finland. It is by far the largest urban district without its own university, resulting in a lower level of research compared with the other large urban regions. The comparative data of the largest urban regions is presented in Table 1. Having a university is seen as one basis for innovation, and a low level of research does not create a good foundation for the image of the Lahti Region as an innovative milieu. The region has, however, decided to start building an innovative milieu through the concept of "network-facilitating innovation policy".

Although lacking its own scientific research, the Lahti Region has a favourable logistic situation: it lies only 100 km from two remarkable research centres, Helsinki and Tampere, enabling a relatively easy transfer of scientific knowledge to the practice-based innovation processes. The yearly research inputs in 2004 per person were 1, 800 euros in the Helsinki Region and 2, 530 euros in the Tampere Region whereas in the Lahti Region it was only 255 euros. The situation in the Lahti Region has forced it to develop new tools to trigger innovation processes. One aim of the network-facilitating innovation policy is to search for structural holes between the regional knowledge-base and the scientific knowledge-base found in the surrounding research centres.

Table 1: Large urban regions: population, relative share of people in polytechnics and universities, R&D costs per region. (Source: Statistics Finland 10/19/2005)

Urban Regions	Population in the region People	In polytechnics, share of people over 15 years %	In universities, share of people over 15 years %	Degrees in polytechnics or universities, share of people over 15 years %	R&D Million euros	€/ resident	R&D index (whole country = 100)
Greater Helsinki	1, 224, 257	3.2	6.1	33.3	2, 212.1	1, 806.9	181.7
Jyväskylä	163, 390	4.7	10.3	27.4	180.8	1, 106.6	124.0
Kuopio	118, 050	5.6	6.2	27.3	101.2	875.3	82.6
Lahti	169, 386	3.5	0.1	21.5	43.3	255.6	23.2
Imatra-Lappeen-ranta	109, 791	3.1	6.0	21.2	77.8	708.6	
Oulu	202, 898	3.9	9.2	29.7	663.0	3, 267.7	226.4
Tampere	313, 748	2.9	9.9	28.2	793.8	2, 530.1	248.1
Turku	290, 524	3.3	8.8	26.8	315.0	1, 084.2	107.1
Vaasa	88, 798	6.9	9.3	27.4	88.3	994.4	94.3

The Lahti Region is thus lacking the important scientific resources to produce radical innovations. However, during the last 30 years it has built a local higher education infrastructure, currently consisting of Lahti Polytechnic and Lahti University Consortium[1]. This infrastructure gives the region the potential to create functioning innovation policy methods. During the 2000s, the region has systematically built a regional innovation system based on the network-facilitating innovation policy. By means of the network-facilitating innovation policy, the regional innovation system is developed in a way that the regional resource platform can be exploited benefiting both the private and public sectors. Because of the narrow regional resource platform, attention must also be paid to the inter-regional networking and accumulation of active communication networks to get all the knowledge needed in the region and spread the reputation.

The special task of the network-facilitating innovation policy is to produce practice-based ways of action to remove the obstacles of innovativeness and bring the needed knowledge in support of the innovation processes. The network-facilitating innovation policy in the Lahti urban region should especially (Lahti urban region innovation environment development strategy 2005):

- create practice-based innovation processes
- create multi-actor and multi-disciplinary innovation networks to support the objectives set in other regional strategies
- bring the knowledge located outside the region to the use of the local actors by means of inter-regional networking
- promote generating creative social capital and creative collective eruptions in the networks
- promote collective learning including managing the future knowledge, tacit knowledge and explicit knowledge
- eliminate the bottlenecks and problems in the networks and hindering the networking
- prevent the development of the regional lock-ins with an active search for new development paths

[1] Lahti University Consortium is a university network of the branch units of four universities located in Lahti. There are about 200 employees and about 8,000 students in the Consortium. The Consortium focuses mainly on the fields of adult education, regional development and technology transfer. The Polytechnics are college-level institutions having about 5,000 students and 500 employees in the Lahti urban region.

- create chances and interfaces for coincidences

The goal of the Lahti urban region innovation environment development strategy (2005) is to turn Lahti into a region with the best practice-based innovation activities in Finland and the best developer of the public sector innovativeness and productivity in Finland.

The goals of network-facilitating innovation policy place special demands on the entire regional system and especially its absorptive capacity, information brokerage and the forms of social capital.

Method and data

To study the absorptive capacity we chose to analyse the individual persons' level. Following the theoretical underpinnings presented earlier in this paper, we formed a measure of affective and cognitive attitudes towards innovative activities. The measure items followed a 5-point Likert scale (1= strongly disagree… 5= strongly agree). Due to the nature of the group studied, we did not follow the traditional random sample procedure; instead we applied purposeful sampling methods with predetermined criteria (Patton, 1990: 176-177). The decisive criteria for inclusion in the sample were
1) the person is a knowledge producer, knowledge mediator or knowledge user;
2) the person operates within a local organisation known to be involved in developing the region's innovation activity;
3) the person could be contacted by e-mail;
4) the person works on the management level or as an expert.

After the formation of the sample list, the survey was sent to 505 individuals and after one reminder 235 acceptable questionnaires were returned. The respondents represent local companies, educational and research organisations, as well as public organisations within the Lahti Region in Finland. The response rate was 46.5 % which might be considered satisfactory. The survey was conducted in autumn 2005.

Table 2: Background information on the respondents

		N=235	%=100
Age	-30	15	6.4
	31-40	51	21.7
	41-50	82	34.9
	51-	85	36.2
	Not responded	2	0.8
Sex	Male	137	58.3
	Female	96	40.8
	Not responded	2	0.9
Organisation	Companies	35	14.9
	Research and education	109	46.4
	Public org.	64	27.2
	Mediator org.	22	9.4
	Not responded	5	2.1
Time in current position (years)			
	-1	42	17.9
	2-5	84	35.7
	6-10	57	24.3
	11-	29	12.3
	Not responded	23	9.8

As the background information in Table 2 shows, over one-third of the respondents were in the last age class (older than 51 years, 36.2%). The next largest representation was the group from 41 to 50 years (34.9%). Men had a slight majority (58.3%) over women. Nearly half of the respondents work in research or educational organisations (46.4%). Public organisations had the next largest representation (27.2%). Regarding work history 35.7% of the respondents had worked in their current position from 2 to 5 years.

The research items[2] and an exploratory factor analysis

On a scale of one to five the highest mean had an item V9 "I dare say even my craziest ideas out loud to my closest colleagues" (mean 4.28). Items V7 "If I fail I will work out why afterwards" (4.12) and V8 "I make an effort to get the others to understand what I want to say" (4.07) had means over 4.0. Reading between the lines we might conclude that item V3 ("The atmosphere in my immediate work environment is open", mean 3.97) corresponds to the respondents. Together with item V2 ("My immediate work environment easily accepts new working methods", mean 3.02) we could speculate that these variables describe an environment with a high bonding element of social capital.

Item V6 "I transfer knowledge between different people and organisations" (4.03) and item V4 "I feel that one of my main tasks is to bring new ideas to the region" (3.71) could indicate that most of the respondents feel like mediators of knowledge. Items V1 "In my organisation, everyone speaks a common language" (2.93) and V5 "I am well aware of what different organisations do for this region" (2.86) received less than average means (3.00). We could conclude that in order to increase the absorptive capacity these figures should be higher considering the respondents.

To group the data and find possible hidden variables behind the data, a factor analysis was done. A principal component analysis was conducted to enable further analysis. An exploratory analysis with Varimax rotation produced three factors with an eigenvalue over 1.00. The model explains 57% of the variance (see Table 3). The value of the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.688 which can be considered good. Communalities range from 0.466 to 0.636, the highest was with variable V1 and the poorest with variable V9.

Table 3: Rotated factor matrix (only loadings over 0.5 are presented)

Variable	Mean	Std.deviation	Factor 1	Factor 2	Factor3	Comm.
V1	2.93	1.218	0.793			0.636
V2	3.02	1.145	0.741			0.583
V3	3.97	1.115	0.725			0.567
V4	3.71	1.165		0.758		0.581
V5	2.86	1.260		0.728		0.554
V6	4.03	0.922		0.713		0.539
V7	4.12	0.844			0.789	0.626
V8	4.07	0.831			0.758	0.585
V9	4.28	1.022			0.576	0.466
Cronbach's Alpha			0.656	0.602	0.539	
Eigenvalue			2.474	1.403	1.261	
% of variance explained			27.484	15.594	14.006	
Cumulative			27.484	43.078	57.084	

Principal component analysis. Varimax rotation.
KMO measure of sampling adequacy 0.688 can be considered good.

[2] NOTE: Variable names freely translated from the original questionnaire in Finnish.

Factor 1: The first factor represents 27.5 % of the total variance of the data. It received three loadings ranging from 0.725 to 0.793. “In my organisation, everyone speaks a common language” had the strongest loading (0.793). Also “My immediate work environment easily accepts new work methods” (0.741) and “The atmosphere in my immediate work environment is open” (0.725) describe the respondents’ view of their immediate work environment and how the environment itself encourages individuals to transfer knowledge within their own organisation. Altogether these features represent the first factor: *Organisational bonding absorptive capacity*.

Factor 2: The second factor represents 15.6 % of the total variance of the data. Three items loaded to this factor range from 0.713 to 0.758. The strongest loading was with an item “I feel that one of my main tasks is to bring new ideas to the region” (0.758). “I am well aware of what different organisations do for this region” (0.728) and “I transfer knowledge between different people and organisations” (0.713). Altogether the three items describing the ability to see oneself in a position between different networks represent the second factor: *Regional bridging absorptive capacity*.

Factor 3: The third factor represents 14.0 % of the total variance of the data. “If I fail I will work out why afterwards” had the strongest loading (0.789). “I make an effort to get others to understand what I want to say” (0.758) and “I dare say even my craziest ideas out loud to my closest colleagues” (0.576) are part of the third factor. The items describe the way an individual handles his or her failures and has the courage to share ideas even at the risk of being laughed at. The lack of excessive guardedness represents the third factor: *Personal initiating absorptive capacity*.

Cluster analysis

The analysis was continued with a cluster analysis in which we used the factor scores computed. The cluster analysis led to a three-cluster model (see Table 4).

Table 4: A three-cluster solution of absorptive capacity in groups of the sample

Cluster	Individuals	Factor 1	Factor 2	Factor 3
1	65	-0.82745	0.59784	0.62399
2	119	0.69019	0.05458	-0.07506
3	37	-0.76618	-1.22579	-0.85479
Factor 1: Organisational bonding absorptive capacity				(F 89.802; prob .000)
Factor 2: Regional bridging absorptive capacity				(F 99.332; prob .000)
Factor 3: Personal initiating absorptive capacity				(F 4.418; prob .013)

The first cluster consists of 65 people. Factors 2 and 3 got positive values (cluster centres 0.60 and 0.62) while factor 1 was clearly negative. Therefore, the respondents in this cluster appear to value personal absorptive capacity combined with regional bridging absorptive capacity. They would not place much importance on an organisation’s inner absorptive capacity. This attitude could refer to an independent person who spreads the message he strongly believes in to other organisations. Therefore, we named this cluster *the Missionaries*.

In the second cluster organisational bonding absorptive capacity got the highest value (cluster centre 0.70) when both regional bridging absorptive capacity and personal initiating absorptive capacity were close to nil. The respondents in the second cluster (119 persons) have a strong feeling of solidarity and feel their organisations’ absorptive capacity is high but are indifferent to the region’s or personal absorptive capacity. We named this group *the House Mice*.

In the third cluster the values in all the factors were negative. The strongest was regional bridging absorptive capacity (cluster centre -1.23). It can be concluded that the respondents of this cluster (37 persons) see none of these absorptive capacities as being strong. On the contrary, they might even be reluctant participate in innovative processes that seek to develop new ideas and change the local status quo. We named this cluster the *Passive Resistance*.

Discussion

In order to implement practice-based innovation activities and exploit the hidden potential in the innovation system, Lahti Region and its actors should possess certain abilities. There should be individuals with an excessive number of weak links and some in the structural holes of networks so that the chance to getting in touch with new knowledge would increase. The actors of the area should have high absorptive capacity and enough creativity to process the knowledge and the social capital to make the most of the tacit knowledge different people possess.

Based on empirical findings, three forms of absorptive capacity were found: 1) Organisational bonding absorptive capacity, 2) Regional bridging absorptive capacity and 3) Personal initiating absorptive capacity. Organisational bonding absorptive capacity includes principally bonding social capital and is favourable in assimilating and transforming knowledge in innovation processes. Such absorptive capacity enables the information brokerage of the acquired knowledge to the exploitation in realised innovation processes. Regional bridging absorptive capacity includes bridging social capital and is favourable in acquiring diverse knowledge in the innovation processes. Such absorptive capacity enables information to be brokered over the structural holes and secures the diversification of the regional knowledge-base. Personal initiating absorptive capacity includes more bonding than bridging social capital and is favourable in all the forms of absorptive capacity. It describes the personal will to take risks and positively continue after mistakes. Therefore, it can be described as including features of a master class information broker in the immediate work environment.

Cluster analysis revealed three types of groups: Missionaries, House Mice and the Passive Resistance. One might think that the Missionaries are the most important group in the innovation processes. May be so, but this is not the whole truth: processing innovations is not just spanning the structural holes and getting new ideas. It is mostly hard long-term work including work in quite closed environments. Therefore, the House Mice at least are essential for the realised absorptive capacity. The absorptive capacity of a regional innovation system requires the right amalgam of different actors. The analysis of the right kind of amalgam is left for future research. However, based on these empirical findings we can say that absorptive capacity with the actors in the Lahti Region will not be a hindrance in the application of the network-facilitating innovation policy.

References

Adler, P. & Kwon, S.-W. (2000) Social Capital: The Good, The Bad and The Ugly. In Lesser, E. L. (ed.). *Knowledge and social capital foundations and applications*. Butterworth-Heinemann, Boston.

Autio, E. (1998). Evaluation of RTD in Regional Systems of Innovation. *European Planning Studies*, Vol. 6, No 2, pp. 131–140.

Bohm, D. & Peat, F. D. (1992). *Tiede, järjestys ja luovuus*. Gaudeamus, Helsinki.

Boschma, R. (2003). *The competitiveness of regions from an evolutionary perspective*. Paper presented at the Conference of Regional Studies Association, Pisa Italy, 12–15 April 2002.

Burt, R. S. (1992). *Structural Holes: The Social Structure of Competition.* Harvard University Press, Boston, USA.

Burt, R. S. (2004). 'Structural Holes and Good Ideas'. *American Journal of Sociology,* vol. 110, no 2, pp. 349-399.

Braczyk, H.-J., Cooke, P. & Heidenreich, M., ed. (1998). *Regional Innovation Systems.* Routledge. London, UK.

Camagni, R. (1995). Global Network and Local Milieu: Towards a Theory of Economic Space. In Conti, S., Malecki, E. and Oinas, P. (eds.). *The Industrial Enterprise and Its Environment: Spatial Perspectives.* Avebury, Aldershot.

Cohen, W. & Levinthal, L. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly* 35: 128–152.

Cooke, P., Uranga, M. & Etxebarria, G. (1997). Regional Innovation Systems: Institutional and Organisational Dimensions. *Research Policy* 26: 475-491.

Doloreux, D. (2002). 'What should we know about regional systems of innovation'. *Technology in Society* 24: 243 – 263.

Edquist, C. (1997). Systems of Innovation Approaches – Their Emergence and Characteristics, in C. Edquivst *(*ed.) *Systems of Innovation: Technologies, Institutions and Organizations,* Chapter One. Pinter Publishers. London, UK / Washington, D.C., USA:

Foray, D. (2004). The economics of knowledge. Cambridge, Massachusetts: The MIT press.

Granovetter, M. (1973). The Strength of Weak Ties. *American Journal of Sociology,* 78: 1360–1380.

Granovetter, M. (1985). 'Economic Action and Social Structure: The Problem of Embeddedness', *American Journal of Sociology*, 91: 481–510.

Granovetter, M. (2005). The Impact of Social Structure on Economic Outcomes. *Journal of Economic Perspectives,* vol. 19, no 1: 33 – 50.

Harmaakorpi, V. (2004). Building a Competitive Regional Innovation Environment – the Regional Development Platform Method as a Tool for Innovation Policy. Doctoral Dissertation. Helsinki University of Technology. Espoo.

Harmaakorpi, V. & Melkas, H. (2005). Knowledge Management in Regional Innovation Networks: The Case of Lahti, Finland. *European Planning Studies*,13, 5, 641 – 659.

Harmaakorpi, V. & Mutanen, A. (unpublished manuscript). Knowledge Production in Network-based Innovation Processes - Interrogative Model as a Research Method. To be submitted to *Industry and Innovation*.

Himanen, P. (2004). *Välittävä kannustava ja luova Suomi. Katsaus tietoyhteiskuntamme syviin haasteisiin*. Eduskunnan kanslian julkaisu 4/2004, Helsinki.

Hayek, F.A. (1945). The use of knowledge in society. *The American economic review.* Vol. 35, No. 4, p 519–530.

Johansson, F. (2004). *The Medici Effect: Breakthrough Insights at the Intersection of Ideas, Concepts and Cultures*. Harvard Business School Press, Boston.

Kim, L. (1998), Crisis Construction and Organisational Learning: Capability Building in Catching-up at Huyndai Motor, *Organization Science*, 9: 506-521.

Kline, S. & Rosenberg, N. (1986). An overview on innovation, in Landau, R & Rosenberg, N. (editors). *The Positive Sum Strategy*, pp. 275 – 305. National Academy Press. Washington, D.C., USA.

Kostiainen, J. (2002) *Urban Economic Development Policy n the Network Society*. Tekniikan akateemisten liitto, Tampere.

Lahti urban region innovation environment development strategy (2005).

Lundvall, B.-Å. (1988). Innovation as an Interactive Process: From User-Producer Interaction to the National System of Innovation. In Dosi, G., Freeman, G., Nelson, R., Silverberg, G. and Soete, L. (eds.) *Technical Change and Economic Theory*. Pinter, London and New York, pp. 349-369.

Lundvall, B.-Å. & Borrás, S. (1999). *The Globalising Learning Economy: Implications for Innovation Policy*. Office for Official Publications of the European Communities. Luxembourg.

Lundvall, B.-Å. & Johnson, B. (1994) The learning economy. *Journal of Industry Studies*, 1, 2, 23–42.

de la Mothe, J. & Paquet, G. (1998) (eds.). *Local and Regional Systems of Innovation.* Kluwer Academic Publishers. Boston, USA / Dordrecht, NL / London, UK.

Nahapiet, J. & Ghospal, S. (1998). Social Capital, Intellectual Capital and the Organizational Advantage. *Academy of Management Review*, 23, 2, 242–266.

Niinikoski, M-L & Valovirta, V. (2005). Välittäjäorganisaatiot auttavat innovaatioiden etäyhteistyössä. In: Koskenlinna, M., Smedlund, A., Ståhle, P., Köppä, L., Niinikoski, M-L., Valovirta, V., Halme, K., Saapunki, J. ja Leskinen, J. (eds.). *Välittäjäorganisaatiot – moniottelijat innovaatioita edistämässä*. Helsinki: TEKES, Teknologiakatsauksia 168/2005.

Nonaka, I. & Konno, N. (1998). The Concept of "Ba". Building a Foundation for Knowledge Creation. *California Management Review*, 40, 3: 40 – 54.

Nonaka, I. & Reinmöller, P. (1998). The legacy of learning. Toward endogenous knowledge creation for Asian economic development. *WZB Jarhbuch 1998:* 401 – 433.

Nonaka, I. & Takeuchi, H. (1995). *The Knowledge Creating Company*. Oxford University Press. New York, USA.

OECD (1998). *Technology, Productivity and Job Creation. Best Policy Practices.* OECD. Paris, France.

Olson, M. (1982). *The Rise and Decline of Nations.* Yale University Press. New Haven, USA.

Patton, M. (1990). *Qualitative evaluation and research methods*. Beverly Hills, CA: Sage.

Parjanen, S., Frantsi, T. & Harmaakorpi, V. (unpublished manuscript). Spanning the Structural Holes – Collective Creativity in Heavily Cross-Disciplined Innovation Processes. To be submitted to *Creativity and Innovation Management.*

Portes, A. (1998). Social Capital: Its Origins and Applications in Modern Sociology. *Annual Review of Sociology*, 24, 1–24.

Putnam, R. D. (1995). Bowling alone: America's declining social capital. *Journal of Democracy*, 6, 1: 65 – 78.

Schienstock, G. & Hämäläinen, T. (2001). Transformation of the Finnish innovation system. A network approach. Sitra Reports series 7. Hakapaino, Helsinki.

Schumpeter, J. A. (1942). *The Theory of Economic Development*. Oxford University Press, London, UK.

Smedlund, A., Ståhle, P. ja Köppä, L. (2005). Välittäjäorganisaatiot ja jaettu johtajuus. In: Koskenlinna, M., Smedlund, A., Ståhle, P., Köppä, L., Niinikoski, M-L., Valovirta, V., Halme, K., Saapunki, J. ja Leskinen, J. (eds.). *Välittäjäorganisaatiot – moniottelijat innovaatioita edistämässä*. Helsinki: TEKES, Teknologiakatsauksia 168/2005.

Sotarauta, M. & Mustikkamäki, N. (Eds.) (2001). Alueiden kilpailukyvyn kahdeksan elementtiä. [The eight elements in regional competitiveness]. Helsinki: The Association of Finnish Local and Regional Authorities, Acta no 137.

Storper, M. (1997). *The Regional World: Territorial Development in a Global Economy*. The Guilford Press, New York.

Tura, T. & Harmaakorpi, V. (2005). Social Capital in Building Regional Innovative Capability. *Regional Studies* 39(8):1111 - 1125.

Walker, G., Kogut, B. & Shan W. (1997). 'Social Capital, Structural Holes and Formation of an Industry Network', *Organization Science*, vol. 8, no 2, pp. 109 – 125.

Zaheer, A. & Bell, G. G. (2005). 'Benefiting from Network Position: Firm Capabilities, Structural Holes, and Performance', *Strategic Management Journal*, 26: 809–825.

Zahra, A. Z. and George, G. (2002). "Absorptive Capacity: A Review, Reconceptualization, and Extension", *Academy of Management Review*, Vol 27, No 2, pp.185-203.