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Towards a regional innovation system?
The role of a regional university

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Abstract

This is a study of development of a network towards an innovation system in the context of a cluster in mature electronics industry, and how the regional university can contribute as a catalyst in this process. Innovation is acknowledged as one of the most important factors on value creation. Promotion of innovation can be seen as the promotion of clustering and networking because innovation is more and more seen as the product of the co-ordinated efforts of many people distributed in different organisations, private as well as public. Hence a lot of effort and resources have been made to try to create and govern network and innovation systems, but they rarely succeed. A regional university may contribute in developing a network towards an innovation system by organizing tailored inter-organizational courses, on the condition of a pedagogy based on network reflections. In this study of the long run effects of such a course I find a significant increased networking, some innovations and the further development of an innovation system. Network Reflections may thus be a concept by which universities can contribute as catalysts to institute forms of collaboration that energize networking, innovation, and the development towards innovation systems.

Introduction

The introduction of the notion 'regional innovation systems' (Lundvall, 1992; Cooke, 1998) in the early 1990s was a response to the challenges facing economic growth in Europe, because of globalization and the decreased importance of the national state. The concept combines the acknowledgement of local embedded knowledge as a vital source of innovative activity, and the idea that innovation is firmly linked to networks. Rather than taking place in a single spot, where a few bright actors are able to break out of the mainstream of thoughts and actions, innovation is more and more seen as the product of co-ordinated efforts of many people distributed in different organisations, private as well as public. From this perspective, the promotion of innovation can be seen as the promotion of networking and regional innovation systems.

There is a substantial and rapidly growing literature about how innovative networks and regional innovation systems work (for an overview, see Hoang & Antoncic, 2003; Doloreux & Parto, in press; Cooke, in press). One should expect this literature to encompass broad discussion on how to *create* appropriate forms of co-operation, but such discussions are, however, relatively rare. The purpose of this paper is to raise and discuss this issue, how to *create* innovative regional networks.

With Zaltman, Duncan & Holbek (1973:10), I define innovation in a broad way as "any idea, practice or material artefact perceived to be new by the relevant unit of adoption". What is new can be new products, new services, new methods of production, new markets, new sources of supply, and new organizational methods (Johannessen, Olsen & Lumpkin, 2000). Hence my focus is not merely on products and technology. The concept 'regional innovation systems' is heavily disputed (e.g. Cooke, in press; Doloreux & Parto, in press), and there is a broad discussion on how to define it, where two main bodies of research, systems of innovation and regional science, influence the discussion. There seems however to be an agreement, that a regional innovation system involves co-operation in innovation activity between firms and knowledge creating and diffusing organizations, such as universities, colleges, training organizations, R&D institutes, technology transfer agencies, business associations, and finance institutions, and the innovation-supportive culture that enables both firms and systems to evolve over time (Asheim & Herstad, 2002; Doloreux & Parto, in press).

The empirical point of departure is the development of a "Management Academy" launched to promote innovation, improve management practices and increase network activity within a regional network of enterprises and their partners in the public support apparatus. The network is called "Electronic Coast", and consists of around 30 enterprises within the electronics industry, Vestfold University College, the municipality of Horten, and the county of Vestfold, all in Norway. When the "Management Academy" was started, the purpose was not to create a network from scratch, but to improve and enhance competencies and connectedness within an existing network structure. The need for improved co-operation was linked to the assumption that improved co-operation would promote innovation within the participating enterprises. The "Management Academy" consists of tailored research-based courses developed and organized as a network activity, where the enterprises and the College collaborate. The core method in these tailored courses is 'network reflections', a pedagogic method of experienced reflections (Mintzberg, 2004), with relatively short theoretical presentations and lectures, followed by tasks to reflect and discuss the students' practice and experience. This is a method that enables the participants to share and create local explicit and *tacit* knowledge, and which is combined with an inter-organizational network factor. Two questions arise. (1) *Did Network Reflections succeed in increasing network relationships within Electronic Coast?* (2) *If increases in network relationships could be identified, did these have any bearing on innovation?*

My *main claim* is that, although it is difficult to govern the creation of a regional innovation system, a regional university may contribute in developing an existing network into a regional innovation system, by organizing tailored inter-organizational courses in collaboration with the network, based on a pedagogic of network reflections. This occurs through increased connectedness among the participants, and through increased innovation as a result of both the number of, and the content of, these connections.

Electronic Coast and the Management Academy

The electronics industry in Vestfold today consists of around 95 enterprises, encompassing some 2.500 workplaces (Idås, 2000). Its development started with one enterprise in 1964, and its growth during the first 30 years was dominated by spin-offs. Over the last 10 years there have been some modest ups and downs, but close to zero growth in the number of enterprises and employees. Some enterprises have gone bankrupt, but nearly all have re-emerged in a slimmer form. There have also been a few spin-offs. In recent years some small new start-up enterprises have emerged, and one new enterprise has been established (Photonyx in 1999).

The enterprises are mostly sub-suppliers, the rate of export is around 90%, and competition is strong and global. These firms represent a modern high-technology research-intensive industry. Up to 20% of the business is research initiated, and the academic level of the engineers is high, several having Masters and PhD degrees. The products need a long, complex, expensive and demanding process of development. Many of the enterprises are influenced by electronics components becoming smaller and smaller, into micro-technology and nano-technology. The technical competence of the employees is good. All the enterprises are classified as SMEs, with the number of employees varying from 2 to 250.

From the outset, various forms of relationships existed between the enterprises. The network called "Electronic Coast" grew out of these relationships, 38 organizations currently participate; in addition to the enterprises and public organizations we find the largest regional business bank and a regional culture centre.

The name Electronic Coast is inspired by Silicon Valley, "Electronic" because the kind of enterprises, and "Coast" because it is geographically a coast region. The Electronic Coast (EC) concept dates back to the days of the Horten College of engineering early in the 1980s, and was, after a sleeping period, re-established as a REGINN project financed by The

Research Council of Norway in 1998. This EC-project was committed to arena- and network building, with the aim of promoting growth and innovation in electronic- and ICT-based companies in Vestfold. Secretarial competence was hired from a regional business centre owned by the County. A professional web site was set up, coloured newsletters printed and distributed by post-mail, and EC-pubs were organized as a free meeting place for the employees in the membership companies. The pubs had a formal programme with short presentations and talks, and an informal part for social mingling. From my point of view, the network activity in 2000 was almost symbolic, a nice surface, but nearly empty inside with only one active team, consisting of representatives from 5 enterprises and the College. The project period ended officially in 2001. The EC-project was in serious trouble: no more money from the Research Council, no secretary help, no newsletters, a web site out of date and the EC-pubs had came to an end because of lack of interest.

In 2000 the enterprise representatives in the only active team wanted to establish a common management course for the enterprises, in order to increase both the competence and the networking. The result of this initiative was the establishment of the "Management Academy" in cooperation with Vestfold University College in 2001. The academy was organized as a project, with the team member from the College as a head of the project. It is easy to assert that the firms and College collaborate, but such assertion can be more or less symbolic. To illustrate the level of collaboration, I will tell a story from the process of developing the first education programme, the one that became the case in this paper:

> At the first planning meeting the enterprises had a lot of suggestions and requests about the content, organizing and study form, and they had a constructive exchange of views. They also requested several public figures to teach. The title of the course was decided to be "Managing Knowledge". Some weeks later they met again and the head of the project (HP) had arranged all the inputs and calculated the fee, and introduced the results. The enterprises (E) approved most of it, but found the fee of 14 500.- NOK/student too high. The following dialogue happened:

> HP: "What is the maximum fee you will pay for this course?"
> E: "10 000,- NOK"
> HP: "Then we have to reduce the number of public figures and the hours of supervising."
> E: "Please remove the public figures and try to keep the hours of supervising as many as possible, and recalculate."

The fee became 9 900,- NOK - and the course a success - without public figures.

To recruit students, information and application forms were post-mailed to the CEO of all the enterprises in the network, and e-mailed to everybody on the network's e-mail list. There was a need for 25 students to start the course, and 4 weeks before start up 15 applications were received. The HP was advised to call the CEO's at every enterprise without applications, promote the course and tell them which enterprises that were going to participate. 2 weeks later the number of applications was 27, and the decision made to start the course.

The acknowledgement of the first course at the Management Academy, as a kind of changing point in the network, has inspired this research project.

The Network Reflection course

The 27 students represented 15 electronics and ICT enterprises and the regional hospital. 5 students were top managers and 22 middle managers. 13 of the middle managers had a job focusing on production and technical tasks, and 9 on human resources and/or budgeting. 19 of the students had a technical education, mostly engineering, 9 of these in combination with managerial education, and 8 had a managerial education only. 7 of the students were women and 20 men.

The pedagogic method involved a kind of experienced reflections (Mintzberg, 2004), with relatively short theoretical presentations and lectures, followed by tasks to reflect and discuss the students' practice and experience in relation to the theories presented. According to Mintzberg (2004:254) experienced reflections are "wondering, probing, analyzing, synthesizing and connecting" about *why* things happened and *how* the situation was similar and different from other situations. This requires struggling with theoretical models and experience, and people need to be curious, alert and engaged – "there has to be a vibrancy in the classroom", with personal and involved educators. The participants need to reflect alone and collectively in small groups and in class, and "it is critical that this reflection alone be allowed to happen on the manager's own terms" (2004:255). The method also enables the participants to share and create local explicit and *tacit* knowledge.

The present case study was the first course at the Management Academy, it was part time (15 ECTS), lasted from September 2001 to June 2002, and the subject was Managing Knowledge. The learning objective was how to organize and support increased learning and knowledge creating in the enterprises. The topics: The concept of knowledge, learning on individual, group and organizational level, tacit and explicit knowledge, learning psychology, human motivation, organizational structure, organizational culture, creativity and innovations, core competence, intellectual capital and the manager as a supervisor. The content and study methods were, beside the topics, adjusted to the students' expectations. These expectations were investigated at the first seminar. The students were asked to reflect on their expectations first individually, then two by two, and finally in a plenary session.

The 8 seminars were mainly during the daytime, and one seminar with over night stay. The locality varied, and some of the seminars were at plants, including plant visits. At every seminar two fixed items, enterprise presentations and network-news were on the programme. I assume this, together with the plant visits and inter-organizational task- and thesis groups, to increase the student's knowledge about each others jobs, enterprises and the feeling of being a member of the network-family. In advance of each seminar, the students received an e-mail with the lecture-note, literature advices and a detailed program to the next seminar. They were expected to meet prepared having minimum read the notes, which they mostly did. The task activities at every seminar were organized in teams, and the teams reorganized at each session. Hence during the course all the students had collaborated and interacted in teams with all the others. In addition they had been reflecting and discussing each other's practices with colleagues from different enterprises, and with the same concepts and lectures as a mutual 'backcloth'. I will give two examples:

> At the first seminar the students were given a practical task: To make the lunch. One group had to go to the kitchen and prepare the food, another group to lay and decorate the table, a third group to entertain us during the meal, and inform us by the history of the place. This lunch project was a success in two ways: It resulted in a nice and amusing meal, and the "ice" between the students melted. Still four years later I experience stories referring to this particular happening.

> Some seminars later the students were asked to reflect on their own learning process, first individually, then in small groups and at last in a plenary session. Which thoughts

do you have? What have you started to use in your job? They shared their thoughts and experiences and were surprisingly honest.

In the thesis, they had to deal with practical challenges in the enterprises, and the groups consisted of participants from 2-4 different organizations. E.g. one group consisted of the CEO and sales manager in one enterprise, and three participants from different other enterprises. Their topic was identification of core competence in the enterprise of the CEO. In the reflection part of their thesis they acknowledged the benefit of collaboration with outsiders helping them to open their own blindness. They also report on great deal of openness, confidence and spirit. Another group consisted of people from two enterprises, and their topic was to develop mutual forms for appraisal interviews applying the theory of human motivation. All the participants appeared to discover a lot of common tasks outside the formal educational process. They also found it useful to visit each other's businesses.

This kind of pedagogical method of experienced reflections combined with the inter-organizational network factor, which also includes enterprise presentations and network news, I will denote as a new concept 'network reflections'.

After 5 seminars, the participants were asked in a questionnaire "which of the expectations are most important to you now?" Those scoring highest were self- development, network building, and relevance to their own work situations, with the latter being the best met expectation. Just after the end of the course, the participants were asked in a questionnaire at which level the expectations were met on a scale from 1 to 5, 1 meaning to a very low degree and 5 to a very high degree. The number of respondents was 17 (63 % response rate). The results show that friendly seminars (4.4), network building (4.2), self-development (4.0), new impulses (3.9), and relationships to their own work situations (3.8) scored highest (mean values in brackets).

My interpretation of the high scores in the evaluations on relevance to their own work situations, network building, and self-development, is that the course succeeded in practising network reflections. The attendance at the seminars was high, and all the participants completed their theses. The final examination was a four-day home examination, 26 of the 27 participants participated in and passed the examination, with good results.

Did Network Reflections improve on network relationships?

The first research question is '*did network reflections succeed in improving on network relationships within Electronic Coast?*' This was investigated by observations and collecting data and from the participants. In addition to the 27 participants data were collected from the main teacher and head of the project (the same person), the total number of respondents was thereby 28. Network relationships were analysed by measuring connectedness and ties at three points in time: 1) spring 2001, some months before the course started, 2) spring 2003, approximately 9 months after the course ended, 3) autumn 2004, approximately 2 ½ year after the course ended.

Connectedness

Connectedness were considered by measuring frequency of three kinds of contact: face-to-face, telephone, and e-mail. Data was collected by structured telephone interviews in October 2004. The frequency was measured on a scale involving Granovetter's (1973) classification into often, occasionally, and rare, but the scale was more finely graded to catch several nuances in the frequency of contact. Contact was measured on a scale from 0-5: 0) no contact at all, 1) once a year or less, 2) between once a year and four times a year, 3) between four times a year and once a month, 4) between once a month and twice a week and 5) at least twice a weak. The response rate was 100%.

The reliability of the three kinds of contact measured at the three points in time showed a Chronbach's Alpha of 0.88 in spring 2001, 0.81 in 2003 and 0.89 in autumn 2004. Factor analysis at the three points loaded significantly on one factor. It can be argued that a quantitative measure of face-to-face contact, telephone contact, and e-mail contact is not a suitable measure for connectedness. You can meet someone face-to-face without interaction, and when you have the e-mail address it is easy to send an e-mail to someone. But you do not pick up the phone and call someone if it is not for the purpose of interaction, and especially not when you have the possibility to send an e-mail simply to give a message or information. The high reliability and significant factor analysis strongly indicate that I am measuring the same phenomenon, which I denote as connectedness. The mean values of connectedness, illustrated in figure 1, were 3.5 in spring 2001, 10.2 in spring 2003 and 8.1 in autumn 2004.
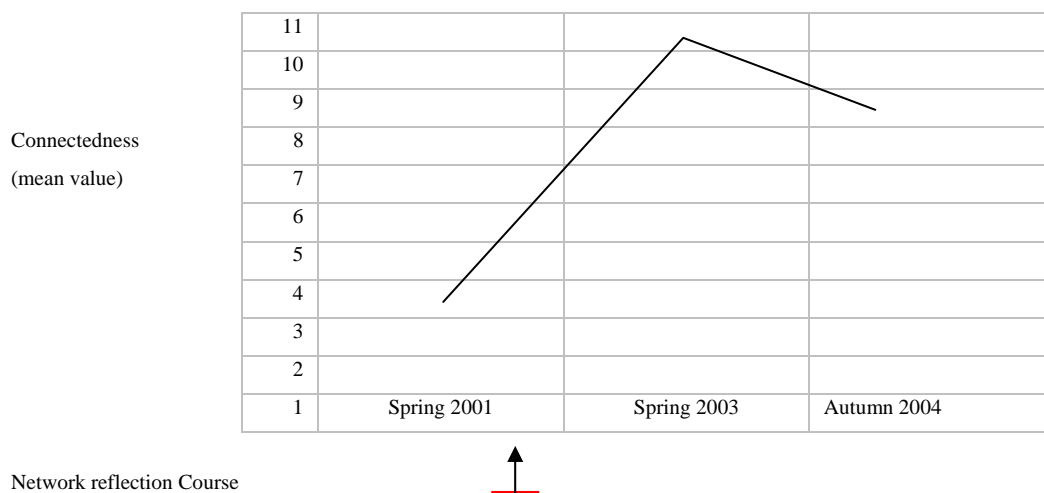
Connectedness
(mean value)

11			
10			
9			
8			
7			
6			
5			
4			
3			
2			
1	Spring 2001	Spring 2003	Autumn 2004

Network reflection Course

Figure 1. *Developing of Connectedness (N=28)*

The increase in connectedness from before to 9 months after the course ended was 196%. Then the connectedness declined somewhat (21%), but was still, 2 ½ year after the course ended, 135% higher than before the course started. This is in accordance with my assumptions that the connectedness would increase considerably straight after the course, but would decline somewhat when the enthusiasm of novelty decreased. I am, however, surprised that the decline was so little, and the level of connectedness so high, so long after the course. My interpretation is that lasting connectedness is useful connectedness.

Analysis of the data shows that the increase in connectedness was not evenly distributed, but mainly caused by 15 of the respondents. For 8 respondents connectedness was almost unchanged, and 5 respondents displayed a decrease in all kinds of contact.

Ties

Granovetter (1973:1365) refers to a tie as a "local bridge of degree *n*" if n represents the shortest path between two points (other than itself) and n>2. "The strength of a tie is a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confining), and the reciprocal services which characterize the tie" (Granovetter, 1973:1361). A given tie is strong, weak or absent (Granovetter, 1973). The mark of strong ties is connections with high intensity of emotional closeness and frequent communication (Granovetter, 1973; Burt, 1992). Granovetter (1973) defines the content of weak ties as distant and infrequent relationships that are efficient for accessing novel information. As a measure for tie strength Granovetter (1973) uses frequency of contact, and divides the

frequency into the categories often, occasionally, and rarely. Often (strong tie) is measured as contact at least twice a week, occasionally (weak tie) less than twice a week but more than once a year, and rarely (absent tie) once a year or less. The change in number of ties, is presented in Table 1.

	Spring 2001	Spring 2003	Autumn 2004
Number of strong ties	3	3	4
Number of weak ties	45	139	97
Mean value of weak ties	1.6	5.0	3.5
Weak ties % change from spring 2001		209	116

Table 1: *Number of strong and weak ties (N=28)*

The results show that the effect of network reflection on strong ties is almost none in this case. The number of weak ties shows a triplication 9 months after the course ended, then 2½ years after the course, the number had declined, but is still more than double than before the course.

Network relationships

The results of the investigation into the network reflection's effect on network relationships, at the first course at the Management Academy, show that both connectedness and the number of weak ties were greatly enhanced. The answer to the first research question: did network reflection succeed in improving on network relationships within Electronic Coast? Is thus yes for this study. The percentage decline in weak ties was bigger than in connectedness, which means that the level of connectedness increased relatively for the connected actors.

Benefits of increased network relationships?

Since the answer to the first research question was definitely in the affirmative, I wished to discover more about how the increased inter-organizational connectedness and number of ties were used. Connectedness and maintenance of ties are undoubtedly time-consuming, so their content and potential benefits are of interest to us. What do they do together? Hence the second research question: *'if an increase in network relationships could be identified, did this have any bearing on innovation?'*

As mentioned above, the increase in contact was mainly attributable to 15 of the 28 respondents. These 15 were therefore the target group of this part of the investigation, and they were contacted for a new telephone interview in December 2004. One was not available.

The interviews this time were quite open-ended, and the opening question was: "*Last time we talked together you told me that your contact with the other participants had increased. How do you think you have benefited from this contact?*"

When reading and analysing the answers, different categories of benefit were sorted out and counted, and the answers classified into 10 categories, as shown in Table 2. The categories, however, somewhat overlapped. They were also at many levels, for instance with respect to knowledge: from whom the knowledge was learned, how the knowledge was utilized, and its usefulness. This may be the price to pay for open questioning. The advantage lies, however, in richer answers. It may be misleading to count the different categories of statements, because it could lead us to believe that the numbers express all the activity in the categories, which they do not. The question: "how do you think you have benefited from this contact?" is a very open question, and was the first in a telephone interview when the respondents were at work and surely engaged with other matters. The only warning given was an e-mail 1-2 weeks before the interview.

Category of benefit	Number of respondents
Increased interpersonal knowledge (they knew more people and their expertise)	13
Useful job contacts	10
Learning from cases and each other / networks of practice	7
New discussion partners or mentors	4
Development of joint tasks (inter-organizational)	4
Increased trust	4
Energizing / motivating	4
Plan or organize course together	4
'Mutual' workforce	3
Personal / social friendship	2

Table 2: C*ategories of benefit (N = 14)*

In the discussion below I use some quotations translated to English by the author.

The distribution of categories among the informants varied from 1 to 6, with the majority scoring on 3 to 5 categories. Nearly all the respondents reported that their *interpersonal knowledge* had increased. Some of the respondents quoted: "I have obtained a phenomenally good network thanks to Electronic Coast". "When I have a problem, I know whom to call". "The benefit for me is that I have become known by people outside the enterprise". Lundvall

and Johnson (1994) denote such knowledge as 'know-who' knowledge and assert this kind of knowledge as increasingly important in the learning economy, because it is so important for innovation. Most of the respondents also stated that the *contacts made were useful in their jobs*. The kinds of benefit that enter into this category are: cooperation with apprentices, learning to use a computer system, sharing of experiences, making use of others' expertise, working better, consciousness raising, reflection on work situations, and hiring lecturers.

Learning from cases. Half of the respondents reported the establishment of close inter-organizational teams where they discussed and solved real-life cases by use of reflections, knowledge sharing and advisory roles. I interpret this as the emergence of networks of practice. In such communities people do not necessarily work together, but are engaged in the same or very similar practices, and therefore share a great deal of insight and implicit understanding (Brown & Duguid, 2000). This category is also of great interest because learning from cases is a far more complex process than a choice between copying and rejecting (Gustavsen, Finne & Oscarsson, 2001:245).

Others report that they use their new acquaintances *as mentors or discussion partners*:

> "I found a very good 'chemistry' with a fellow student who I did not know before the course, I sometimes use her as a mentor". "Nn has functioned as a kind of personal consultant for me during frustrated times. I find it liberating to have somebody outside the electronics industry, really lovely".

Development of joint tasks is another category of benefit, and reported here are three new development tasks between different enterprises, one new commission for the University College, and mutual projects to inspire adult women to accomplish the qualifying examination. *Trust*, which is deemed to be an important condition for innovation (Krogh, Ichijo & Nonaka, 2000; Lundvall, 1996), is reported with confidentiality, and some quotes such as: "We have deep and honest talks". "I believe it has raised trust between us" and finally, "It is again about trust. Things are easier to do, shorter ways of decision-making".

The next category, *energizing and motivating*, is also very interesting. Respondents linked energy and motivation to their job situations. If you are motivated in an energized way, you are probably intrinsically motivated (Deci & Ryan, 1985). According to the theory of self-determination it is reasonable to believe that intrinsic motivation has a positive impact on

individual learning (Deci, 1996; Gausdal, 2001), and creativity (Amabile, 1983; Ganesan & Weitz, 1996; Gausdal, 2001); both variables that may be conductive to innovation. Several of the reported benefits imply new ways or areas in which to utilize the respondents' knowledge. Their know-how is more in demand, which may increase their feelings of competency. Since feeling of competency has a positive impact on intrinsic motivation (Deci, 1996; Gausdal, 2001) , this may be the reason why the respondents find the network relationships energizing and motivating. Since 'knowing more people and their expertise' was the benefit most mentioned, I can assume that a great many of the contacts among the earlier students were about using each other's competencies. This probably increases their feelings of competency, which again has a positive impact on intrinsic motivation. Hence I think this creates a positive circle.

The next category is *planning or organizing* courses together, which subsequently leads to more inter-organizational connectedness. The category *'mutual' workforce* will be presented in the next section. The least frequent category was personal or *social friendship*. I should emphasize that this was the least frequent category, which may be interpreted as a sign of the respondents emphasizing job benefits in their connectedness and relationships, not personal or social interest.

I have attempted to present and interpret the open answers to the questions concerning the respondents' views on the benefits from increased contact, but the second research question has still not been answered. I will return to this in the discussion section.

The managers' judgements

To supplement the findings, a third set of data was collected. This time the target group was a stratified sample of the students' managers, represented by the Vice-CEO of the largest enterprise, the CEO and the HR manager in a smaller enterprise, and the President and Dean at the College. The three interviews were all performed in January 2005. The interviews were open, without an interview guide, and the main question was: "*What do you think are the main results and benefits from the collaboration between the enterprises and between the enterprises and the College?*" The answers are organized into the six categories shown in Table 3.

Results and benefits	Connection with the Network Reflection course
Joint management programmes	Strong
Swift action collaborative competence (AKOM)	Medium
'Mutual' workforce	Medium
Competence network	Medium
Adapted education and research	Weak
Global competition culture	Weak

Table 3: *Reported results and benefits of the collaboration from selected top managers and my consideration of the connection with the NR course*

Joint management programmes. Through the Management Academy the enterprises have worked out joint educational programmes. The collaboration has brought new knowledge to both the enterprises and the College. If each enterprise had chosen to operate on its own, initiatives of this kind would not have been possible. For the College to relate to enterprises in the way accomplished with the electronics industry, the enterprises encompassing the industry need, however, to act together.

Swift action collaborative competence (AKOM). In the spring of 2003 there was a period of acute depression in the industry, among other things due to September 11th and the space travel accident in USA. The French company Alcatel decided to close down its enterprise in Vestfold, the rate of industry closures was high in Norway, and a sense of crisis existed. Then the chairman in Horten proposed to start a common project for unoccupied labour from the electronics industry. To contribute in keeping know-how in the region, stimulate entrepreneurship, and supply the group with new skills. Only two months after the chairman's proposal, the AKOM project was established and in business with a budget of 1.8 million NOK. The project was a joint project between the industry, represented by the EC association, Horten municipality, Vestfold County, the public labour market service and Vestfold University College. Thus different organizations, private and public, representing all three parts in a triple helix (Etzkowitz & Leydesdorff, 1997) were working together in a fast and effective way. In the evaluation, the project was judged to be successful by both users and the organisations involved. The project also attracted attention from top national politicians. Owing to rising economic trends and reduced need, the project ceased in the autumn of 2004. This story shows that the actors in this region, after several years of collaboration, have acquired a collaborative ability and trust that gives a swift action capability when necessary.

'Mutual' workforce. In this industry, large variations in production volume are normal. Eight enterprises that collaborate in "AVANSE" have established an internal system for non-profit hired-out labour among the enterprises. This means they avoid temporary redundancy and dismissal of labour in low production periods, and in the opposite situations they can obtain competent labour quickly. The enterprises save a considerable amount of money because they avoid temporary redundancy and dismissal of labour in low production periods, and turnover costs in employment and training. The enterprises are able to increase production faster and are thus capable of delivering their products more quickly, which gives them a competitive advantage. The workers safety is increased and this collaboration also strengthens the enterprises' ability to reduce uncertainty, and thereby increase their ability to recruit, and prevents know-how disappearing from the industry and the region.

Competence network. A strong regional competence network is created through all these projects. Beside the benefit of increased interpersonal knowledge, this network is of vital importance to the existence of some of the enterprises. Many have foreign owners that put so much emphasis on this matter that the enterprises would be closed down without such a network.

Adapted education and research. Vestfold University College has, as a result of strong pressure from the enterprises, established the first and only engineering education in Norway for a bachelor's and master's degree in micro-technology. In recent years, focused research on applied micro-technology has been undertaken the College, in close collaboration with the enterprises. The main result has been considerably increased competence in micro-technology in the region – which is unique in Norway. Further several of the College's researches in the area of regional development are producing innovation research on the regional electronics industry. The co-operation has definitely influenced the regional college to be more research oriented.

Global culture of competition. Most of the enterprises have a 90% export share and extremely demanding customers. They generally operate, at the same time, in narrow niches in the market. From a narrow niche it is often difficult to overview the broader trends in markets and technologies. Exchange of experience makes it easier for each participant to gain a broader perspective. The result is a culture of global competition, which gives the enterprises increased competitive advantage in their most important markets.

The specific connections between these forms of network benefits and the network reflection course vary from close with the mutual management courses, to medium and weak. The network team AVANSE that organizes the mutual workforce, was enlarged from 5 to 8 enterprises and energized after the course. The AKOM project that demonstrated the swift action collaborative competence was partly built on relationships and experiences from the network reflection course. Hence I claim that the competence network was energized and strengthened. A quotation from the president of the College, who also is a member of EC's board, emphasises these assertions:

> "The first course at the Management Academy appears now to be the crucial element in several of the teams that emerge inside these networks. It was the right people who were there and they have continued to work on, use, and expand the course. Thus the course has been very important. It is not essential to involve a lot of people."

Discussion

The Electronic Coast *project* period ended officially in 2001. I assume the feeling of success with the Management Academy inspired the committee to prolong the Electronic Coast project in 2002. Efforts to continue the work of the EC within the framework of an *association* were crowned with success in June 2003. Many of the central persons who made this effort were students from the Management Academy. At the moment (autumn 2005) the situation for Electronic Coast is a professional general office, 7 active teams and a team manager group, up-dated and frequently visited web-site and monthly EC-news distributed by e-mail. State of affairs for the Management Academy is: Two courses, "Managing Knowledge" and "Management in Projects" have been developed and undertaken. In the spring of 2005 a new activity, "Top Leadership Forum", was started up, and a new educational programme "Commercialization" in the planning stage.

The answer to the first research question, *did Network Reflections succeed in improving on network relationships within Electronic Coast?* Is 'yes' for the case investigated. I argue that network reflections can be a concept `that institutes forms of collaboration that energize networking`, which Brulin (2001) challenged universities to create.

Among other factors, the empirical findings show that increased contact has resulted in environments where the participants are 'learning from cases and each other'. Gustavsen,

Finne and Oscarsson (2001:245) argue that learning from cases is a far more complex process than a choice between copying and rejecting. In addition the issue of local learning environments emerges as a key one, because people need to learn, not to be informed. In these environments they ought to exchange experiences to enrich the available ideas and impulses (2001:245), which they certainly did in this case. I think networks of practice have emerged. Brown and Duguid (2000; 2001) assert that such communities shapes conditions where new ideas can circulate, but they circulate on the back of similar practice, not through collaborative, coordinated practice and direct communication as in a community of practice. They further argue that new ideas will travel along networks of practice until they find a better home and the possibility to be used. Networks of practice constitute an important element, because they trigger processes that might lead to the formation of a regional innovation system.

The tailored network reflections course took place over a period of 9 months. But since then, most of the increased connectedness has been stimulated by the students themselves by contacting each other and creating or enlarging learning environments and networks of practice (some of the environments are, however, energized by action researchers from the College). This is important because, according to Gustavsen, Finne and Oscarsson (2001) and Brown and Duguid (1991), the most fruitful networks and communities are those that grow organically. A quotation from one of the interviews explains how this connectedness has grown in an excellent way:

> The chemistry between people is more important than their jobs. We did homework together and delivered assignments together, and became very close. You continue the contact with those with who you were in the most contact. Many had the same job as me.

I interpret this and the emergence of networks of practice as an evolution of informal institutions such as norms, habits, attitudes, and experience-based knowledge, which stimulate the important issues in regional innovation systems, exchange of information, ideas and know-how between the institutions (Asheim & Isaksen, 1997). This is in great contrast to the point of departure, with Electronic Coast as a top-down mechanically created 'network' financed from public authorities, with a nice surface, but nearly empty content of networking. A more or less symbolic network in serious trouble. I assume that the important difference in networking and innovation is caused by this first network system being a contrived

association while the latter Electronic Coast, after the effects of the tailored Network Reflections course, is more grown organically and hence a more natural system (Checkland, 1999).

The link between specific network-promoting activities and innovation encompasses a number of issues that constitute major challenges. Networking as it emerges from the investigation of Electronic Coast first and foremost pertains to knowledge and insight of a more general kind, and to the ability to do things together that would be beyond the potential of the individual enterprise. If we take 'innovation' in a narrow sense, as new products, or new twists to old products, the relationship to innovation is clearly indirect. My definition of innovation is however a broad definition which also includes e.g. new methods of production and new organizational methods. Although the enterprises belong to the same industry classification, they serve different market niches. Within the industry at large research plays a vital role. However the research has less to do with developing basically new ideas than with making ideas into specific products and processes. Joint development of 'basic ideas' and the like is not an issue, and the need for specific forms of co-operation in product and process development is probably rather limited. Insofar as the notion of a 'regional innovation system' is to be applied to the Electronic Coast co-operation, we can speak about innovations within such areas as are indicated above: These include the joint use of a regional institution for education, research and development, the ability to respond together to labour market and other challenges, and the ability to launch efforts that would go beyond the capacity of each enterprise. Because we consider the Management Academy and the network reflection courses as new organizational methods and new methods of production, they also represent innovations. Hence the Management Academy is considered both an innovation as it brings something new to the system, and as a mechanism for triggering processes leading the development of a regional innovation system.

There is a dispute within the academic community related to the effect of tie-strength on innovation. According to Granovetter (1973) weak ties have a positive impact on innovation, and strong ties have a negative impact. Reagans and McEvily (2003) argue that the positive effect of knowledge conversion provided by a strong tie, increases up to a point, and then flattens out. Modern researchers (e.g. Uzzi, 1997; Hansen, 1999, 2002) seem to agree that, because of environmental uncertainty and complex knowledge, small networks characterized by strong ties tend to be more valuable for organizations than large networks with weak ties. The empirical findings in this case show that the effect of network reflection on strong ties is

almost none and the effect of building new weak ties is high, but if the development with decreased number of weak ties and increased connectedness continue, strong ties may emerge.

While it can be argued that I can not be sure if the results may become different without using the pedagogy of network reflection, the method consists of a lot of interactions and reflections among the participants, and network building scored the second best at both course evaluations. The method enables the participants to share and create local explicit and *tacit* knowledge, thus cultivates the valuable local knowledge and may give access to localized tacit knowledge spillovers. Tacit knowledge is vital in knowledge creation (Nonaka, Toyama & Konno, 2000) and hence innovation and may enable discovery by bringing explicit knowledge "into the 'unknown' creative space where cognition is tacit but interactive with reality and methodology" (Cooke, in press:5).

The second research question was: If an increase in network relationships could be identified, did it have any bearing on innovation? Because the empirical findings and the discussion above indicate that the present EC-system 'involve co-operation in innovation activity between firms and knowledge creating organizations such as colleges and business associations', the answer to this question is that *I find it reasonable to assume that the tailored network reflection course has contributed to the creation not only of specific innovations, but also to the further development towards a regional innovation system.*

Gustavsen, Finne and Oscarsson (2001:267) argue that innovation demands co-operation – a coalition between actors, and the core element in creating a coalition is to create relationships, or connectedness, and further "*the evolution of the coalition is a part of the innovation process itself*". According to Gustavsen, Finne and Oscarsson (2001:253): "If innovation is our interest we cannot stay content with 'interpreting' the actors in terms of what they bring with them, we need to put the main emphasis on what happens when they meet". In this study I have been putting an emphasis on the latter issue.

Concluding remarks

My *claim* is that, although it is difficult to govern the creation of a regional innovation system, a regional university may contribute in developing an existing network towards a regional innovation system by organizing tailored inter-organizational courses in collaboration with the network. An important condition in such courses may be network

reflections, a pedagogic method based on experienced reflections (Mintzberg, 2004), with relatively short theoretical presentations followed by tasks to reflect and discuss the participants' practice and experience in relation to the theories presented, combined with inter-organizational network collaboration. The method enables the participants to share and create local explicit and tacit knowledge. `Network reflections` is a new concept, developed and introduced in this project.

This development of a network towards a regional innovation system occurs through increased connectedness among the participants and through increased innovation as a result of both the number of, and the content of these connections. I think this happens because the participants form different enterprises by many kinds of mutual reflections, tasks and experiences create new applied knowledge together, learn to know each other, each others knowledge, enterprises and work challenges. Because, by being students in the same class for some months, they belong to the same group, have the same challenges with literature, teachers, thesis and exams. This may enhance the development of social capital (Coleman, 1990) which encourages increased networking when the course is ended. I plan to follow up with investigations of how network reflections may create social capital and trust, and with a paper that conceptualize and discuss network reflections further. It would also be interesting to examine innovation-supportive culture in Electronic Coast.

Acknowledgements

Vitae

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