

The Innovation Management and Partnerships (Knowledge Flow) of the Finnish Small Low Tech Companies

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Abstract

The purpose of this paper is to examine small- to medium-sized enterprises (SMEs) partnerships and co-operation utilization within innovation processes. Industrial firms are gaining ideas for innovation from various sources and their innovative performance depends, besides their internal knowledge resources, also on how successful they are at appropriating knowledge from external sources. This seems to be true also with smaller, low tech and remote firms. According to analysis of Finnish data small low tech companies have a growth oriented innovation activity. The main findings from Finnish cases show that when the renewal is important at the firm level only, cooperation with business partners (consultants, suppliers) is emphasized; however, when the renewal is important at market level then the public sector cooperation with universities etc. is emphasized. 25% of the studied companies had university co-operation. Informal co-operation and short-term education was seen the most important forms of co-operation. The study of SME innovation in Eastern Finland is included in which implemented innovations during 2003–2005 were investigated. This paper is based on a quantitative study of a sample of SMEs located in the Eastern Finland region in Finland. The entrepreneurs completed a research questionnaire which was sent to 3226 entrepreneurs. 381 completed answers were received and the response rate was modest 11,8%, the final analyzed data contains 370 completed answers. The results suggest that the largest backlog appears to be in utilizing universities and public research organizations. The choices of knowledge sources can be attributed to different capabilities of firms and network partners (consumers, universities etc.) in creating and utilizing (exploitation and exploration) respective innovation-enhancing knowledge. Universities and consulting firms also need to exploit new knowledge created in science, practice and by end-users. This means a challenge for universities and other actors to develop their services and capabilities to meet the needs of SMEs and the manner of SMEs to implement innovation processes hand in hand with daily business.

Keywords: Small to Medium-sized Enterprises, Innovation, Innovation management, Company performance, Co-operation, Finland

1. Introduction

Innovation requires creating new knowledge or combining existing knowledge in a novel way. Therefore it rests on learning, which is largely a social process, especially when transfer and accumulation of tacit knowledge is concerned (Polanyi, 1966; Howells, 1995). The capability of a firm to innovate is expanded by broader knowledge base and cost and risk sharing through cooperation with other subjects (suppliers, clients, competitors, universities etc.) (see also Rothwell, 1991; Freel, 2000). Firms need considerable in-house capabilities to recognise and evaluate the new knowledge and technology and thereafter to negotiate and adopt this technology (Cohen & Levinthal, 1990).

Consultants and knowledge intensive business services (KIBS) are used as a more formal and costly way of innovating when the firms own knowledge resources are not sufficient. They are used for several activities (product,

process and design innovation etc.), and the relative importance of these activities probably depends more on the type of innovative activities currently relevant for that specific industry (Ukrainski, 2008).

Universities contribute to local innovation processes in a variety of ways, but most importantly by education and technology transfer. In addition to their own discoveries, universities can help to attract new human, knowledge, and financial resources from elsewhere. This is becoming even more important as globalization has moved into third, metanational phase meaning for example knowledge “hunting” from global sources (Doz *et al.*, 2001). Mode 2 model of knowledge formation emphasizes multidisciplinary approach and knowledge transfer by informal ways during the ongoing research (Nowotny *et al.*, 2004). There are challenges for universities and regional innovation environment arising from too little geographical proximity (Boschma, 2005). The availability of expertise in universities is a crucial factor in industry–public sector research linkage. Faulkner *et al.* (1995) show that the low level of the use of public research institutes as knowledge sources does not imply a lack of research interest in industry, but rather the paucity of available specific public knowledge and modern equipment vital for development. The industry-academia knowledge exchange is recently lively discussed by academics and politicians. In addition for the technology and science based “waterfall” model, other approaches have been introduced. These include, e.g., practice-based and demand-driven models, DUI-model (doing, using, interacting), distributed innovation and non-R&D innovators (Cooke *et al.*, 1997; Arundel *et al.*, 2008).

In the knowledge exchange with universities, it is found that firms’ size constraints are even more important than sectoral specificities, because SMEs face considerable resource constraints to both, formal and informal linkages; and communication problems (Faulkner *et al.*, 1995; Corsten, 1987). The basic issue for a SME is finding a person, enterprise or research organisation providing specific complementary knowledge and combining that new knowledge with the existing one so that it results in new approach and innovation. Faulkner *et al.* (1995) have found that the recruitment policy is relevant because of the networks new employees can bring to the firm (e.g. employees with doctoral or post-doctoral experience usually have networks within academia, but also know literature sources). The other factors they suggest are the proprietary concerns of the firm, but also the openness of senior R&D staff, which from one side reflects the organisational culture, but from the other side also influences it.

The utilization of different kinds of information sources and collaborative relationships are associated with introduction of innovations (e.g. Bigliardi & Dormio, 2009; Tödtling *et al.*, 2009; Freel & de Jong, 2009; Lockett *et al.* 2009; Rossi 2010; Varis & Littunen, 2010). Cohen and Levinthal (1990) state that a firm must have strong internal capabilities and knowledge base in order to innovate and benefit from external information sources. Tether (1998) argues that the understanding of innovations in SMEs is vastly important yet the amount of research conducted reflects the controversy around the innovation phenomenon. For this purpose this paper contributes to the complex yet still particularly essential phenomenon of SMEs partnerships and co-operation utilization within innovation processes.

The purpose of this paper is to examine small- to medium-sized enterprises (SMEs) partnerships and co-operation utilization within innovation processes. Industrial firms are gaining ideas for innovation from various sources and their innovative performance depends, besides their internal knowledge resources, also on how successful they are at appropriating knowledge from external sources. This seems to be true also with smaller, low tech and remote firms.

Our principal research questions may be formulated as follows:

RQ1. What are the main sources for partnership (knowledge flow) for SMEs?

RQ2. What are the main challenges for SMEs to utilize partnership with business partners and public sector?

2. Literature Review

Knowledge interactions between fields of science and economic sectors are quite dispersed and do not follow obvious or simple patterns (Ukrainski & Kajanus, 2011). Firms in traditional sectors are mostly not considered to have a close knowledge exchange with a public sector R&D base, but some empirical studies point to the contrary – the industries under discussion revealed higher intensities of interactive learning with universities. Meeus *et al.* (2004) have found that firms with moderate strength of internal knowledge resources, but also firms creating innovations with moderate complexity have higher probabilities for interactions with public R&D base compared to low and high levels of expertise and complexity.

Most important sources of knowledge relevant in all stages of innovation process are located inside the firm (Ukrainski & Kajanus, 2011). Basic skills of employees, but also their broader knowledge of modern scientific and technological developments is relevant for absorbing the knowledge from external sources (Cohen & Levinthal, 1990). The internal innovation capabilities are enhanced by R&D activities in a certain technological field, but there is a kind of technological capability relevant especially to firms in low- and medium-technology (LMT) industries

such as wood-related ones. This is the capability to introduce new combinations of existing technologies (including architectural capabilities elaborated by Henderson and Clark, 1990). Such capabilities are not reflected in industry's R&D intensities or educational indicators, but competitive markets force the companies in wood sector to be very creative regarding the capabilities of running and readjusting their machinery and equipment. As discussed by Hirsch-Kreisner *et al.* (2003), this demands from firms more tacit knowledge and captures practical engineering problem-solving by engineers and technicians, but also by shop-floor workers. Laestadius (1995) argues that this kind of knowledge in the firm supports also the innovation stemming from external sources to the firm (through collaboration with universities, R&D-institutions or suppliers of machinery and equipment).

Typical IP measures targeted to improving internal knowledge bases of firms are related to training, mobility and subsidisation of specific R&D activities. Forsman (2009) emphasises that enterprises already having appropriate innovation capabilities can best benefit from the provided IP instruments. Highly conceptualized policy instruments meet the needs of large enterprises characterized by efficient internal innovation development processes and clear resource allocation for it (Schumpeter Mark II). Variety of discontinuous public services is focused on accelerating the individual phases of the innovation process. By contrast, the development work in SMEs is fuzzy in nature and goes hand in hand with their daily business without a special development budget. Therefore Forsman (2009) suggests an alternative path for innovation policy: first, starting to improve capabilities for the development of incremental innovations, then forging ahead via radical innovation development. This process can lead to a success spiral that accelerates internal capability building overlapping with innovation development – a continuous and diversified innovation flow as an outcome. This insight is supported also by recent surveys in Europe finding that more than 50% of innovative firms innovate without carrying out R&D (Arundel *et al.*, 2008). They are smaller, active in LMT sectors and located in areas with relative poor innovation infrastructure. However, they are growing at the same rate as their R&D performing counterparts. Arundel *et al.* (2008) bring out several different ways to innovate besides R&D: technology adoption, minor modifications or incremental changes, imitation including reverse engineering, combining existing knowledge in new ways and adopting solutions developed by users (Ukraenski & Kajanus, 2011).

Most external knowledge sources are used to enhance innovation with complementary knowledge but also to reduce associated risks and costs (Ukraenski & Kajanus, 2011). Linkage with suppliers is based on either making or buying relations (Teubal *et al.*, 1991). Amara and Landry (2005) suggest that users are exploited as information source by firms that initiate innovations as the world's first introductions rather than as incremental innovations. Suppliers and customers are sources of foreign knowledge for a firm through exporting goods and services or importing materials and technology as discussed widely in spillovers literature. Both of these partner types have been recognized as a source of innovation knowledge not only for developing processes, but also in developing new products and services and even design activities. Organisational, risk and labour barriers influence knowledge exchange with external partners in a similar way, but the financial constraints have been found to be less relevant in case of suppliers. In some studies, exporting firms have been found to exert greater pressure for upgrading technologies and cooperating more with suppliers.

Openness of knowledge may speed up the pace of innovation as competitors are able to build on other innovators' advances rather than being allowed to block the progress of others (Foray, 1997). Amara and Landry (2005) have concluded on the basis of the existing literature that the information obtained from competitors is related to the increased complexity and intersectoral nature of new technologies, the reduction of uncertainty and R&D costs associated with market access, or the development of product and process innovations (by acquisition and appropriation of the partner's tacit knowledge, uptake of codified knowledge; by reduction of the period between invention and market introduction). However, collaboration with competitors is different because it is typically more informal (although it can also be formalised via R&D contracts or collaboration activities via industry associations). It is not clear however, which part of the knowledge is exchanged – technological, design or market knowledge, or all of the aforementioned.

Freel and Harrison (2006) found that small and middle-sized industrial firms were oriented in their co-operation significantly more to customers and to suppliers than to universities, which are confirmed in this study. They found that significantly many firms weren't in co-operation with other organizations and that the co-operation isn't especially important to firms. They found that the most innovative firms were more oriented in co-operation in their innovation activity. This finds support in the results of this study. They found that in industrial firms in the case of the development of radical innovations, firms were more often in co-operation with other organizations and results of this study confirm this. They found that the most innovative firms had more co-operation with other firms and public sector than other firms.

Soderquist et al. (1997) found that in the innovation activity the most important factors were the needs of the customers, close relations with clients and the operation of the research and development department. The importance of customer relations is shown in this study. For innovation processes the greater co-operation in the firm is important. In this study internal co-operation was found rather important but its importance was highly different among industries.

Koch and Strotmann (2008) found that the knowledge intensive service firms developed a lot of radical innovations, but the results of this study are highly different.

Jenssen and Nybakk (2009) found that external relations are important for small knowledge intensive firms in their innovation activity. This study found that innovative firms are oriented to co-operation more than firms that aren't as innovative.

Hartman et al. (1994) found that innovative ideas were far more common in top management level than in middle management level and in operative level. In this study it was found that an idea from the customer to the entrepreneur was far more common as a source of renewal than an idea from the customer to other member of the staff.

Freel and de Jong (2009) found that radical innovations were far more linked to co-operation of the firms than other types of innovation and it was found that the radical innovations were far more linked to other firms as sources of innovations than firms that developed other types of innovations. This doesn't find support from the results of this study, to some extent the results are different.

Freel (2005) found that middle level innovators were far more oriented to co-operation with other firms. This finds significant support from the results of this study. It was found that firms that are oriented to develop radical innovations are bigger than other firms. In this study it was also found that the market level top innovators and firm level middle innovators were far bigger than other firms.

Varis and Littunen (2010) found that different regional institutions weren't important as co-operation partners or as sources of information. The results of this study are similar. The aforementioned co-operation partners were by far the most important co-operation partners to the firms. The firms in the study are rather low technology firms and that is why the different technology institutions weren't of significant use to them. Varis and Littunen (2010) found that the entrepreneurs regard the competition factors of the entrepreneur and the staff, the initiatives and training of the staff and the organized and unorganized communication not as important sources of innovation. In this study it was found that competitiveness is rather important to the firms and by far most important to market level top innovators and that the own staff was important as a source of innovation in agriculture firms, wholesale and retail firms and in social services firms, and on average it was rather important to the firms. Internal co-operation, which is linked to communication, is a significant factor as a source of innovation to most of the industries. While the training of the staff wasn't examined as a source of innovation, it was important to the firms as a means to develop the know-how.

3. Methodology and Data

This paper is based on a quantitative study of a sample of SMEs located in the Eastern Finland region in Finland. The entrepreneurs completed a research questionnaire which was sent to 3226 entrepreneurs. 381 completed answers were received and the response rate was modest 11,8% yet still statistically valid, the final analyzed data contains 370 completed answers.

The quantitative database needed for this study was collected from joint database of Trade Register of Finland, Statistics Finland, Finnish Asiakastieto Ltd and Fonecta Ltd. The joint database includes all registered companies in Finland and it is widely used in data collection for scientific studies and questionnaires. The 3226 companies were located in Eastern Finland in Finland. Collected data included following information from 3226 companies: Company name and registration number, company address, postal code and post office, company official address, company telephone and fax, company email and www-address, company main industry (+ 3 side industries if available), head office and side office status, export and import status, turnover, personnel, profit and balance sheet, business result %, turnover / person, turnover change %, self-sufficiency and foundation year.

Target group was collected from the 3226 (all companies were located in Eastern Finland in Finland) company data by using the following two criteria. Personnel classification: Unknown, 1-4 personnel, 5-19 personnel and 20-49 personnel. Office location: Head office and side office. The data included the following company forms (legal forms in Finland): Partnership, limited partnership, sole trader, limited company, cooperative and other legal form.

Questionnaires were mailed to target group SMEs totaling 3226. It was planned so that respondent had the possibility to answer by filling up the questionnaire and returning it by mail, the return envelope was enclosed to

each questionnaire. The respondent had also a possibility to answer in web, the instructions and the address for the web answer possibility was enclosed in the covering note. Eccu Finland Ltd. planned and constructed the web-questionnaire page. Eccu Finland Ltd. also activated companies which had not answered in time. The activation included phone calls, emails and text messages. The received answers were entered to database where the data was composed to Excel-format.

Received data by phone interviews was 28,1% (107 companies) of all companies. Email was sent to 206 companies of the target group and by text messages 200 companies were activated to answer the questionnaire. 29,9% (114 companies) of all answers were done before activation and after the activation was completed 70,1% (267 companies) answered.

Overall 51,2% (195 companies) answered by letter, 20,7% (79 companies) answered by web questionnaire page and 28,1% (107 companies) were interviewed by phone. Overall 381 companies out of 3226 answered the questionnaire.

This paper is based on a quantitative study of a sample of SMEs located in the Eastern Finland region in Finland. The entrepreneurs completed a research questionnaire which was sent to 3226 entrepreneurs. 381 completed answers were received and the response rate was modest 11,8 %, the final analyzed data contains 370 completed answers. At present the data has been analyzed by composing the basic distributions. The importance and dependence of executed renewals in the SMEs co-operation and partnerships utilization were examined for this paper. The data is quite heterogeneous so we assumed that variables are not linear with symmetric Gaussian distribution.

4. Analysis and Results

The Factors Restraining and Advancing SMEs Renewal Processes

According to results the data suggests that there are several factors restraining and advancing SMEs renewal processes. SMEs valued co-operation with clients as the most important advancing factor for their businesses. They also valued company's internal knowhow and co-operation and the overall willingness for innovations and renewals. Other quite important factors were infrastructure, information related to customers, markets and research and development, competitiveness of the company and innovation cycle. Factors that are restraining SMEs renewal processes are availability of skilled personnel and risk taking capability.

SMEs Possibilities to Improve Knowhow

According to the results there are also several factors that SMEs are implementing to improve the innovation processes. According to the data SMEs are hiring new personnel to improve innovation processes and they are obtaining knowledge transfer from other organizations, they are also encouraging personnel to education and SMEs are also attending to training seminars. SMEs are also seeking the needed data from literature, data bases, Internet and by knowledge transfer from customers.

According to analysis of Finnish data small low tech companies have a growth oriented innovation activity. The main findings from Finnish cases show that when the renewal is important at the firm level only, cooperation with business partners (consultants, suppliers) is emphasized; however, when the renewal is important at market level then the public sector cooperation with universities etc. is emphasized. 25% of the studied companies had university co-operation. Informal co-operation and short-term education was seen the most important forms of co-operation.

Insert Table 1 Here

Insert Table 2 Here

Insert Table 3 Here

According to analysis the data shows that in the SMEs innovation process and in overall innovation management is improved and restrained by several individual factors. The company needs to keep its internal renewal continuous, internal co-operation must be kept in the core of improvement, renewal willingness and will needs to be high, know-how needs to be also emphasized and the co-operation with customers has to be valued high in the innovation process. The data shows that innovation process in the SMEs is restrained by the lack of qualified personnel and by the low willingness to take any major risks involving innovations.

The data also shows that the co-operation with universities is understood valuable. According to the data 25% of the studied SMEs had co-operation with universities. The analysis shows that informal co-operation and short-term education was seen as the most important co-operation forms. The data also shows that project work, agreement based co-operation and student works (thesis etc) was seen also important co-operation forms.

Analysis

Factors That Further or Constrain the Innovation Activity of the Organization among All Firms

Insert Table 4 Here

The firms have rated co-operation with customers and the know-how in the firm by far the most important factors in implementing the renewal actions. They are also most important to innovators, still they are important to all firms. Also the willingness to renew, that is least important to the least innovative firms both in the market and firm level, the internal co-operation and the renewal speed, that is most important to firm level top innovators, were among the most important factors. The location in relation to customers was by far most important to firm level innovators. The availability of the market information is by far most important to innovators. The availability of premises, machinery and tools is most important to firm level innovators. The co-operation with other firms is most important to innovators. The competence is by far most important to market level innovators, while the financing opportunities are by far the weakest for market level innovators. The availability of business services, that is most important to market level innovators, the willingness to take risks, that increases linearly with the innovation level, and the availability of competent workforce, that isn't as constraining to innovators than to other firms, were the most constraining factors in the renewal of the firm. Most of the factors don't further or constrain the renewal actions.

Factors in Starting the Renewal Actions

Insert Table 5 Here

The firms have rated the willingness to utilize the know-how of the staff of the firm, which is most important to innovators, and the market niche, that is by far the most important factor for market level innovators and for innovators on average, as the most important factors in starting the renewal actions. The competing innovation is most important to market level top innovators and to the innovators on average. The willingness to utilize the know-how of the staff and the market niche for a new product or service have been by far the most important factors in starting the renewal actions. The participation in projects and a scientific breakthrough or a new technology have been by far the least important factors in starting the renewal actions, quite expectedly, because the firms are small and not particularly technology-intensive. The participation in projects has been by far most important to market level innovators, but it isn't especially important even to them.

Sources of Renewal Actions

Insert Table 6 Here

The most important factors as sources of the renewal actions were an idea from customer to the entrepreneur or the management, the firm's own staff and the conversations with entrepreneurs from other industries. Professional literature and other publications, an idea from the firms of the own industry and an idea from the customer to other members of the staff have also had some significance. The professional literature and other publications are the more important the lower the level of innovation and what is interesting is that participation to projects is most important both to most innovative and least innovative firms, although it isn't especially important to even them. Co-operation with research and development institutions is by far most important to market level innovators, but it isn't especially important even to them.

The Means in Developing the Know-how of the Firm

Insert Table 7 Here

The firms have rated the information obtained from the customers that is most important to innovators and increases linearly with innovation level, by far the most important factor in order to utilize different means in developing the know-how. Also the participation of the staff to training events, that is most important to middle-level innovators both in market and firm levels, written materials, databases and the Internet, encouraging the staff to study individually, that is most important to market level innovators at middle level, and information obtained from other firms are quite important. The written material and databases and the Internet were nearly as important to top and middle level innovators at firm level, but at the market level they were far more important to middle level innovators. The recruitment of new staff and participating in projects have been by far most important to market level innovators.

Instant Business Development

Insert Table 8 Here

The firms have rated lectures, seminars and short interval training and free co-operation, that is by far most important to innovators both at market and firm levels, as the most important means in co-operation in instant business development.

Fifth of the firms have participated to EU projects that try to develop and renew the business of the firm. The firms have rated these projects quite useful, the average was 3,31.

The firms have experienced the market growth during the years 2003-2005 to average 3,5 and the increase of competition during the years 2003-2005 to average 3,77, and these should be indicative of the need to develop innovations.

The most common co-operation partners were other firms, the municipal industry services and the development companies.

The firms were most satisfied to other firms, for which the average was 7,85, to polytechnic schools, for which the average was 6,74, and to the entrepreneurial unions and associations, for which the average was 6,71 and to Finnvera, for which the average was 6,68. There are a lot of parties that were only rarely contacted. Lot of firms probably feel that these are quite distant from their point of view and that they are of little use in business development.

The firms were moderately satisfied to polytechnic schools and vocational institutions, while they weren't so satisfied to the universities. Polytechnic schools were contacted twice more often than the universities.

Industrial Firms

Factors That Further or Constrain the Renewal Actions

Insert Table 9 Here

The industrial firms have rated the know-how and the co-operation with customers as the most useful factors that further the renewal actions. For industrial companies the co-operation with other firms is more important than to the firms on average and also the co-operation with other firms and the speed of renewal are quite important factors. The internal co-operation and the willingness to renew aren't as important to industrial firms as to the firms on average. The willingness to renew is far more important to innovators than to other firms. Internal co-operation and financing opportunities are by far most important to firm level innovators. It is noticeable that for top innovators at the market level the location to business partners and customers is far less important than to the firms on average or than to the firm level innovators. For industrial firms the availability of competent workforce is considerably more important in implementing renewal actions than to the firms on average. The only constraining factor on average is the willingness to take risks, but to the innovator firms it is too far lesser extent a constraining factor, especially to market level innovators.

Factors in Starting the Renewal Actions

Insert Table 10 Here

The willingness to utilize the know-how and ideas of the staff and the market niche have been the most important factors in starting the renewal actions, while participation in projects and scientific breakthrough or a new technology haven't been especially important, yet projects are far more important to innovators. The market niche and also the competing innovation is far more important to market level innovators than to other firms. The price competition isn't as important to innovators as to other firms. The willingness to utilize the know-how and ideas of the staff has been more important to the firms than to the firms on average. Also the market niche and participating in projects have been more important to the firms than to the firms on average.

Sources of Renewal Actions

Insert Table 11 Here

The firms have rated an idea from the customer to the entrepreneur or the management by far the most important factor as a source of renewal. Also the staff of the firm, which is most important for market level innovators, and the conversations with entrepreneurs from other industries have been quite important. For the industrial firms an idea from customer to the entrepreneur has been far more important factor as a source of renewal than an idea from customer to other member of staff. This denotes the largest difference among industries. Ideas from the customer to the entrepreneur or to other member of the staff have been more important to firm level innovators than to other firms. Participation into projects is far more important to innovator firms than to other firms and also business counseling is more important and co-operation with educational institutions is more important.

An idea from the customer to the entrepreneur has been far more important for the industrial firms as a source of renewal than for firms on average. Participation to fairs, seminars and training events and co-operation with educational institutions and research institutions has been more important to industrial firms than to firms on

average. The firms have rated the market level innovations to average 2,67 and the firm level innovations to average 2,77 which aren't especially high.

Means in Developing the Know-how in the Firm

Insert Table 12 Here

Information obtained from customers has been by far the most important factor. In the case of the industrial firms its superiority to other factors in this dimension is greatest among the industries and it is by far most important to firm level innovators. Information obtained from other firms and participation to projects are more important than to firms on average and especially the participation into projects is far more important to the innovators. The firms have rated the recruiting of new employees more important than firms on average. The firms have rated encouraging the staff to study individually not as important as the firms on average and it is more important to innovators.

Instant Business Development

Insert Table 13 Here

The firms have rated these as more important than the firms on average and they are far more important to firm-level innovators than to other firms. Contract-based co-operation is far more important to market level innovators than to other firms. The firms have rated lectures, seminars and short interval training not as important as the firms on average.

Industrial firms were far more active in participating to EU projects than the firms on average. The firms rated these projects to average 3,55, which means that they were quite useful.

The firms experienced the market growth to average 3,45 and the increase of competition to average 3,61 and these are relatively high.

The most common co-operation partners for the industrial firms were other firms, the development companies and the municipal business services. The firms were most satisfied to other firms to average 8,73, municipal business services to 7,61 and Finnvera to 7,21 and Tekes to 7,17. The industrial firms were by far most satisfied to other firms as co-operation partners.

The analysis of specific industry; wholesale and retail, knowledge intensive companies, transport, construction, accommodation and restaurant, social services, culture and free time and agriculture firms.

5. Discussion and Conclusions

Our main results suggest that the largest backlog appears to be in utilizing universities and public research organizations. The choices of knowledge sources can be attributed to different capabilities of firms and network partners (consumers, universities etc.) in creating and utilizing (exploitation and exploration) respective innovation-enhancing knowledge. Universities and consulting firms also need to exploit new knowledge created in science, practice and by end-users. This means a challenge for universities and other actors to develop their services and capabilities to meet the needs of SMEs and the manner of SMEs to implement innovation processes hand in hand with daily business.

The purpose of this paper is to examine small- to medium-sized enterprises (SMEs) partnerships and co-operation utilization within innovation processes. Industrial firms are gaining ideas for innovation from various sources and their innovative performance depends, besides their internal knowledge resources, also on how successful they are at appropriating knowledge from external sources. This seems to be true also with smaller, low tech and remote firms.

Our principal research questions are as follows:

RQ1. What are the main sources for partnership (knowledge flow) for SMEs?

RQ2. What are the main challenges for SMEs to utilize partnership with business partners and public sector?

According to analysis of Finnish data small low tech companies have a growth oriented innovation activity. The main findings from Finnish cases show that when the renewal is important at the firm level only, cooperation with business partners (consultants, suppliers) is emphasized; however, when the renewal is important at market level then the public sector cooperation with universities etc. is emphasized. 25% of the studied companies had university co-operation. Informal co-operation and short-term education was seen the most important forms of co-operation. Our analysis suggests that in the SMEs innovation process and in overall innovation management is improved and restrained by several individual factors. The company needs to keep its internal renewal continuous, internal co-operation must be kept in the core of improvement, renewal willingness and will needs to be high, know-how needs to be also emphasized and the co-operation with customers has to be valued high in the innovation process.

The data shows that innovation process in the SMEs is restrained by the lack of qualified personnel and by the low willingness to take any major risks involving innovations.

According to the results there are also several factors that SMEs are implementing to improve the innovation processes. According to the data SMEs are hiring new personnel to improve innovation processes and they are obtaining knowledge transfer from other organizations, they are also encouraging personnel to education and SMEs are also attending to training seminars. SMEs are also seeking the needed data from literature, data bases, Internet and by knowledge transfer from customers. The data also shows that there are factors that are affecting negatively to SMEs utilization of partnerships and co-operation. Although the need for skilled personnel is seen as a possibility to improve but it is also restrain for companies. The data suggests that the risk taking capability is also restraining the companies to utilize the maximum of partnerships and co-operation with business partners and public sector.

The data also shows that the co-operation with universities is understood valuable. According to the data 25% of the studied SMEs had co-operation with universities. The analysis shows that informal co-operation and short-term education was seen as the most important co-operation forms. The data also shows that project work, agreement based co-operation and student works (thesis etc) was seen also important co-operation forms.

The analysis of the data is still unfinished at the moment. The data itself is quite heterogeneous and the sample is also quite small, altogether 370 companies. The target group is also quite dispersed. The results of this paper are only directional. For further studies SMEs innovation capabilities should be analyzed more thoroughly. One possibility is that innovation capabilities are analyzed by Imp3rove analysis tool. The standard activities of universities should also be studied, how successful and productive these activities has been and what has been achieved.

Analysis of the Factors among Industries

Competitiveness is most important to health firms, knowledge intensive business services and wholesale and retail firms. Internal co-operation is most important to accommodation and restaurant services, to social service firms, to knowledge intensive business services and to construction firms. Willingness to renew is most important to social service firms, to free time oriented firms, to knowledge intensive business services and to accommodation and restaurant services. Willingness to take risks is most important to free time oriented firms and it is most constraining to construction firms. The renewal speed is most important to construction firms. The location in relation to customers, to business partners and to business services is most important to social service firms. The reach, the structure and the viability of the distribution network is most important to wholesale and retail firms. Co-operation with other firms is most important to industrial firms and to free time oriented firms. Co-operation with customers is most important to free time oriented firms and social service firms. The availability of premises, machinery and tools are most important to knowledge intensive business services. The know-how in the firm is most important to knowledge intensive business services. The availability of market information is most important to free time oriented firms. The availability of research and development information is most important to free time oriented firms and knowledge intensive business services. The price competition is most important to accommodation and restaurant services, to wholesale and retail firms and to social service firms. A competing innovation is most important to free time oriented firms. The market niche is most important to wholesale and retail firms, to knowledge intensive business services and to industrial firms. The willingness to utilize the know-how of the staff is most important to knowledge intensive business services. An idea from the customer to the entrepreneur is most important to industrial firms and to accommodation and restaurant services. An idea from the customer to other member of the staff is most important to accommodation and restaurant services, to wholesale and retail firms and to social service firms. An idea from other firms in the industry is most important to wholesale and retail firms, to accommodation and restaurant services firms, to social services firms and to free time oriented firms. Own staff is most important to an agriculture industry, to wholesale and retail firms and to social services firms. Participation in projects has been most important to industrial firms and to social services. The professional literature and other publications are most important to an agriculture dominated industry firms, to accommodation and restaurant services, to knowledge intensive business services and to transport firms. The participation in projects is most important to social services firms. The encouragement of the staff to study individually is most important to social services firms and to knowledge intensive business services. Information obtained from customers is most important to free time oriented firms. The social services firms experienced more than other firms that their markets experienced growth, while the firms in wholesale and retail industry, accommodation and restaurant firms and transport firms experienced the highest increase of competition. The industrial firms were by far most often contacted to universities. Free time oriented firms, social services firms and industrial firms and an agriculture dominated industry of firms were by far most contacted to polytechnic schools.

The wholesale and retail firms, the social service firms and an agriculture dominated industry firms are most satisfied to co-operation with universities, while the knowledge intensive firms aren't satisfied to them. The social services firms, free time oriented firms and transport firms are most satisfied to polytechnic schools, while the knowledge intensive business services aren't satisfied to them. The social services firms have been by far most satisfied to management consultancies. The most networked industries in terms of entrepreneurial acquaintances were social services and transport firms, of which the last two also had most other than entrepreneurial acquaintances, and industrial firms. The free time oriented firms, social services firms and industrial firms participated most often to EU projects, while the most satisfied were knowledge intensive business services.

The willingness to utilize the know-how of the staff and the market niche have a heightened importance in relation to other factors in starting renewal actions in industrial firms, knowledge intensive business services firms, transport firms and construction firms.

The willingness to utilize the know-how of the staff has been by far the most important factor in relation to other factors in starting the renewal actions in knowledge intensive business services, in accommodation and restaurant services and in social services.

The willingness to utilize the know-how of the staff wasn't among the two most important factors in starting the renewal actions in the free time industry.

The market niche wasn't among the two most important factors in starting the renewal actions in accommodation and restaurant services firms.

The know-how hasn't been among the two most important factors in furthering the renewal actions in accommodation and restaurant services and in social services industry.

The know-how and the co-operation with the customers have a higher importance in relation to other factors in furthering the renewal actions in the wholesale and retail industry, in knowledge intensive business services and in accommodation and restaurant services.

The internal co-operation is the most important factor in furthering the renewal actions in accommodation and restaurant services industry. This is the only industry where this dimension is among the two most important factors and in addition among all industries this wasn't among the most important factors in this dimension. Although the internal co-operation is the third most important factor for the firms on average, it is the third most important factor only in knowledge intensive business services, it is the fourth most important factor in wholesale and retail industry, in transport industry, in social services industry and in construction industry and it isn't among the most important factors in industrial firms and in agriculture dominated industry and in free time firms.

Although the speed of renewal is the fourth most important factor in furthering the renewal actions among the firms, it is the fourth most important factor only in industrial firms and in agriculture dominated industry.

The competence of the firm is among the most important factors in furthering the renewal actions in the wholesale and retail industry, in knowledge intensive business services, in social services and in construction firms, although it isn't among the most important factors among all industries.

The co-operation with other firms is among the most important factors among industrial firms, free time oriented firms, in agriculture dominated industry and wholesale and retail firms, although it isn't among the most important factors among all industries. Among the social services firms it was important, although it wasn't among the most important factors.

The availability of information linked to research and development is among the most important factors among knowledge intensive business services, in agriculture dominated industry and in free time oriented firms, although it isn't among the most important factors among all industries.

The reach, structure and viability of the distribution network is among the most important factors among the accommodation and restaurant service firms, transport firms, construction firms and in agriculture dominated industry.

The availability of market and customer information is far more important to free time oriented firms than to other industries.

The location in relation to customers is far more important to social services firms than to firms in other industries. Also the location in relation to other firms is more important to firms in this industry than to firms in other industries, while it is far less important to construction firms, free time oriented firms and knowledge intensive business services firms. The location in relation to customers is far more important than the location to other firms among knowledge intensive business services, construction firms and social services firms.

The location in relation to business services is a constraining factor in implementing the renewal actions in accommodation and restaurant services, in construction firms and in free time oriented firms. The free time oriented industry was the only industry where the location in relation to customers, to other firms and to business services is constraining factors.

The willingness to renew is among two most important factors in furthering in the renewal actions the social services industry. This is the only industry where this dimension is among the two most important factors.

An idea from the customer to the entrepreneur is by far the most important source of renewal among the industrial firms, accommodation and restaurant services and transport firms.

The own staff is by far the most important source of renewal among the wholesale and retail firms, in social services firms, construction firms and agriculture dominated industry.

An idea from the customer to the entrepreneur isn't among the two most important sources of renewal among construction firms and in agriculture dominated industry and in free time oriented industry.

The own staff isn't among the two most important sources of renewal and this is the only industry where this dimension isn't among the two most important sources of renewal.

The information obtained from the customers is by far the most important means in the development of know-how in industrial firms, wholesale and retail firms, in accommodation and restaurant services, in transport firms, in construction firms, in social services and in a agriculture dominated industry. In knowledge intensive business services firms and in construction firms it wasn't as significantly the most important means.

Although the participation of the staff is the second most important means in developing the know-how, it is the second most important factor only in social services firms and in transport firms. It has been the third most important factor in wholesale and retail firms, in knowledge intensive business services, in accommodation and restaurant services, in construction firms, in agriculture dominated industry and in free time oriented industry and only in the industrial firms it wasn't among the three most important means.

Although the written material linked to the development of the know-how, databases and the Internet is the third most important means in the development of know-how in all firms, it is the third most important means only in industrial firms. It is the second most important means in knowledge intensive business services, in accommodation and restaurant services, in construction firms, in agriculture dominated industry and in free time oriented industry.

Although the participation into training, lectures and seminars and short interval training is the second most important factor in the immediate business development among the firms, it is the second most important factor only in the in the wholesale and retail industry, in knowledge intensive business services and in agriculture dominated industry. The participation into training and lectures and seminars and short training and free co-operation have been by far the most important factors in the immediate business development.

The price competition is more important to accommodation and restaurant services and to social services than to all firms, although the difference isn't significant.

Competing innovation is far more important to free time oriented industry than to other industries.

Participating into projects in starting the renewal actions is far more important to free time oriented firms than to other industries. It has been most important to free time oriented firms, to industrial firms and to agriculture dominated industry. Participating into projects is more important as a means to develop the know-how and in immediate development of the business than in the furthering of the renewal actions or as a source of renewal, although the difference isn't significant. Participating in projects has some significance in starting renewal actions in free time firms and as a means to develop the know-how in social services firms and in the immediate development of the business in free time firms, in social services firms and in accommodation and restaurant services.

Although the conversations with other entrepreneurs are the third most important factor, they are the third most important factor only in industrial firms and wholesale firms and they are the second most important factor in knowledge intensive business services, in transport firms and in construction firms. They are the most important factor in free time oriented firms.

An idea from the customer to other member of the staff is more important to accommodation and restaurant services and to social services and to wholesale and retail firms than to other industries. These are industries where the staff and the customers are in closest interaction with each other.

Although the written material linked to the development of know-how, databases and the Internet are the third most important factor in the development of the know-how, they are the third most important factor only in industrial

firms and they are the second most important factor in knowledge intensive business services, in accommodation and restaurant services, in free time firms and in agriculture dominated industry and they are far more important to them than to other industries.

The encouragement of the staff to study individually is most important to knowledge intensive business services, social services wholesale and retail firms. In industrial firms it isn't important.

Information obtained from other firms is far more important to knowledge intensive business services firms than to other industries.

The recruiting of new staff is most important among agriculture dominated industry and in social services.

Theses have some significance in the immediate development of the know-how among social services firms in wholesale and retail firms, in industrial firms and in accommodation and restaurant services.

The municipal business services are by far most important to top level market innovators. In the market level they are far more important to low innovators than to middle level innovators, but this isn't so to firm level innovators, where the firms don't have as great differences. The industry associations are most important to the market level top innovators and they are also important at the firm level, although the difference isn't so great. The top innovators and low innovators are by far the most in co-operation with them. Top innovators are most in co-operation with universities and the difference is greater in the market level than in the firm level. The market level innovators are by far most in co-operation with polytechnic schools and the difference to other firms is greater than co-operation with universities and the top innovators and low innovators are most in co-operation with them. The firm level top innovators are most in co-operation with vocational institutions and the top innovators and the low innovators are most in co-operation with them. The top innovators are by far most in co-operation with development companies, regional business services and consultancies. The firm level top innovators are by far most in co-operation with other firms.

The contract-based co-operation has some significance among industrial firms.

The main sources of partnership for the firms in the study are municipal business services, industry associations, universities, polytechnic schools, vocational institutions, development companies, Finnvera, municipal business institutions, consultancies and other firms.

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Table 1. The importance of renewal

	Market level	Firm level
Insignificant = 1 ¹	41,4	37,3
2	24,7	18,5
3	20,3	21,2
4	9,2	13,7
Very important = 5	4,4	9,2
Total	100	100

Note: ¹ Five-point Likert-scale (1 = Insignificant to 5 = Very important).

Table 2. Importance of co-operation, renewal valuable to firm level

Co-operation	Insignificant renewal (Contacts by firm)	Very important renewal (Contacts by firm)	P-level ²
Universities	1,8	2,4	0,040
Public institutions	2,0	4,0	0,152
Financiers	1,6	1,9	0,072
Companies	7,8	10,6	0,002**

Note: Statistical significance: Statistically significance, if $p \leq 0,001 = ***$; Statistically significance, if $0,001 < p \leq 0,01 = **$; Statistically significance, if $0,01 < p \leq 0,05 = *$; Statistically significance, if $0,05 < p \leq 0,1$.

Table 3. Importance of co-operation, renewal valuable to market level

Co-operation	Insignificant renewal (Contacts by firm)	Very important renewal (Contacts by firm)	P-level ²
Universities	1,7	3,3	0,030*
Public institutions	1,8	6,6	0,004**
Financiers	1,4	3,2	0,013*
Companies	8,7	6,7	0,102

Note: Statistical significance: Statistically significance, if $p \leq 0,001 = ***$; Statistically significance, if $0,001 < p \leq 0,01 = **$; Statistically significance, if $0,01 < p \leq 0,05 = *$; Statistically significance, if $0,05 < p \leq 0,1$.

Table 4. Factors that further or constrain the innovation activity of the organization among all firms

Factors	Value
Co-operation with the customers and know-how in the firm	3,88
Willingness to renew	3,55
Internal co-operation	3,49
Renewal speed	3,47
Location to customers	3,29
Availability of market information	3,29
Availability of premises, machinery and tools	3,28
Location to business partners	3,26
Co-operation with other firms	3,2
Availability of research and development information	3,2
Competence of the firm	3,19
Financing opportunities	3,11
Reach and structure and viability of distribution network	3,08
Location to business services	2,97
Willingness to take risks	2,88
Availability of competent workforce	2,74

Table 5. Factors in starting the renewal actions

Factors	Value
Willingness to utilize the know-how of the staff	3,55
Market niche	3,40
Price competition	3,06
Competing innovation	3,01
Participation in projects	2,10
Technological breakthrough or a new technology	1,97

Table 6. Sources of renewal actions

Factors	Value
Idea from the customer to the entrepreneur	3,36
Own staff	3,29
Conversations with entrepreneurs from different industries	2,98
Professional literature and other publications	2,72
Idea from other firms in the industry	2,70
Idea from the customer to other member of the staff	2,59
Participation to fairs, seminars and theme events	2,36
Business counseling	2,24
Participation in projects	2,19
Collaboration with research and development institutions	2,11
Participating in associations' events	2,01

Table 7. The means in developing the know-how of the firm

Factors	Value
Information obtained from the customers	4,00
Participation of the staff to training events	3,40
Written material, databases and the Internet	3,3
Encouragement of the staff to study individually	3,14
Information obtained from other firms	2,92
Recruitment of new staff	2,45
Participating in projects	2,32
Commercial services	1,97

Table 8. Instant business development

Factors	Value
Lectures and seminars and short-interval training	2,98
Free co-operation	2,96
Theses	2,56
Contract-based co-operation	2,52
Participating in projects arranged by universities	2,39

Table 9. Factors that further or constrain the renewal actions

Factors	Value
Know-how in the firm	3,84
Co-operation with customers	3,69
Co-operation with other firms	3,54
The speed of renewal	3,47
Location in relation to business partners	3,34
Availability of premises, machinery and tools	3,32
Location in relation to customers	3,30
The reach, structure and viability of the distribution network	3,30
Willingness to renew	3,28
Availability of market information	3,24
Competence of the firm	3,2
Internal co-operation	3,2
Location in relation to business services	3,19
Availability of competent workforce	3,19
Availability of research and development information	3,00
Financing opportunities	3,00
Willingness to take risks	2,79

Table 10. Factors in starting the renewal actions

Factors	Value
Willingness to utilize the organization know-how of the staff	3,68
Market niche	3,68
Price competition	3,03
Competing innovation	3,00
Participation in projects	2,47
Technological breakthrough or a new technology	1,97

Table 11. Sources of renewal actions

Factors	Value
Idea from the customer to the entrepreneur	3,87
The staff	3,38
Conversations with entrepreneurs from other industries	2,97
An idea from other firms in the industry	2,62
Participation to fairs, seminars and theme events	2,59
Idea from the customer to other member of the staff	2,58
Participation in projects	2,56
Professional literature and other publications	2,55
Business counseling	2,48
Co-operation with educational institutions	2,41
Participating in associations' events	1,97

Table 12. Means in developing the know-how in the firm

Factors	Value
Information obtained from customers	4,04
Information obtained from other firms	3,11
Written material, databases and the Internet	3,00
Participation of the staff to training events	2,95
Recruitment of new staff	2,78
Encouraging the staff to study individually	2,68
Participating into projects	2,46
Commercial services	2,06

Table 13. Instant business development

Factors	Value
Free co-operation	3,17
Theses	2,82
Contract-based co-operation	2,72
Participation into projects	2,5
Lectures, seminars and short-interval training	2,5