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Innovation activity in the SMEs: What factors do have effect?

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Innovation activity in the SMEs: what factors do have effect?

ABSTRACT

The aim of this study is to clarify what factors affect the innovation activity of small and medium-sized enterprises (SMEs), and especially the effect of regional factors. Innovations are seen as central phenomena on both micro and macro levels in economy. However, we know little about the formation, development and diffusion of innovations in different milieus. The different types of branch and enterprise structure might be the essential factor that accounts for regional differences in innovation activities. Many studies show remarkable differences between branches. Additionally, the resources of firms give an unequal starting point for innovation activities. Our study observed that the differences between regions were smaller than anticipated. It also found the innovation profiles in different areas to be fairly convergent. The growth, networking and strategies of companies best explain the differences in SME innovation activity.

Keywords: innovation, innovation activity, innovation strategy, SMEs, local milieu, interaction

JEL: O31

1 Introduction

Small and medium-sized enterprises (SMEs) are becoming increasingly involved in the global competitive market. In spite of the different development phases, the regions have to meet similar change factors which affect the business activities: technological change, internationalisation, strengthening competition, dominance of the market. The changes in the market affect particularly strongly the SMEs located in more peripheral regions, where firms have generally relied on the local market but now find themselves in a highly competitive environment.

Success in today's competitive environment requires a company to innovate and renew its operations and resources. It seems that acquiring and applying new knowledge, required for the formation, development and adoption of innovations, is connected to the possibilities the region offers. Naturally, the possibilities the region offers to innovations vary. Regions with a strong infrastructure of know-how and versatile firms offer better chances for innovation activities than peripheries where there are few firms and the infrastructure of know-how is thin.

There are many definitions of the concept of innovation. According to a narrow interpretation, innovation means radical renewal (invention) or technological product or process innovation. According to Porter (1990), innovation can be broadly defined to include both improvements in technology and better methods or ways of doing things, which can be manifested in product changes, process changes, new approaches to marketing, and/or new forms of distribution. The broader interpretation may be adopted to include changes which are new to an individual firm, even though other firms have already adopted such changes. These different definitions have resonance from the standpoint of regional development. Having a broader approach to innovation would make it possible to focus on peripheral regions (Storhammar & Virkkala 2003a).

Innovations and interaction

The views on the birth process of innovations have changed along with new research. The idea of the birth of innovations formed by the linear model and product cycle theory is considered too simple and applicable only to some innovations (Kaufmann & Tödtling, 2000). It has been shown that the innovation process is a more complex phenomenon, influenced by various social factors. Innovation is not seen as a separate incident but as reforms which are connected to social and financial goals, and possibly also to technological ones. By nature, innovation is rather a learning process than a separate incident. Regime is considered a central feature of an innovation process. This means that decisions made earlier and existing structures direct innovation processes. This path dependency applies to the ability of producing and adopting innovations of both regions (Bellandi, 1997) and firms (Kautonen & Tiainen, 2000; Lawson & Lorenz, 1999). Same kinds of processes are connected to the diffusion of innovations as to the birth process of innovations (Rogers, 1995).

It has been shown that innovations are based on interaction networks more firmly than earlier, and the birth and adoption of innovations is examined as an interactive process: learning takes place through interaction and results in an innovation. Both *inter-*

action within the firm and interaction with the firm's milieu, created through networking, are considered important to successful innovation activities. (Harris et al., 2000.)

The innovation process of a firm is closely connected to external interaction networks. Through business, firms are in constant interaction with their suppliers and clients. Competitors and even other firms in the region also play a role in the innovation activities of a firm. Firms often have connections with public and private organisations which produce information, as well as with financiers and other organisations which influence the firm's activities. Thus, the interaction networks that influence the birth of innovations are linked with the characteristics of regions as well as of lines of business.

Innovations and milieu

It seems that acquiring and applying new knowledge, required for the birth of innovations, is connected to the possibilities the region offers. Moreover, the cumulative nature of innovation activities emphasises the important role of the region. The regional aspect is of particular importance in those lines of business which are active in innovations. In more mature lines of business, the firms' connections are directed more towards their own line, less to the region (Breschi, 2000). Naturally, the possibilities the region offers to innovations vary. Regions with a strong infrastructure of know-how and versatile firms offer better chances for innovation activities than peripheries where there are few firms and the infrastructure of know-how is thin (Malmberg & Maskell, 1999).

A regional innovation structure is based on the interaction networks mentioned above. In central areas interaction as a structure which provides information and know-how takes a firm and versatile form more easily than in distant regions. In more remote regions, a firm has fewer chances for regional interaction and connections with central area networks depend on the firm's own activity. The level of innovation activity varies greatly in different lines of business (Palmberg, 2001). This creates further problems in regions outside central areas, in which the emphasis is on conventional, low technology lines of business (Niittykangas, 1999).

The networking of firms can be seen to rise from both necessity and voluntary effort for fruitful cooperation. All firms must interact with their milieu, which brings an element of necessity to interaction relations. However, it is estimated that interaction will expand even further, due to the firms' own interests (Curran et al., 1993): the number of cooperative connections of firms grows; cooperation becomes more intensive and the connections more permanent. It can be presumed that the networking of firms will be based more and more on their strategic behaviour. The networks live and thus the firms' strategic choices change them. From the viewpoint of the strategic behaviour of a firm, networks do not form a fixed structure: the networks are dynamic, which may enable the firm to benefit in competition. Personal contacts are emphasised in the networking of small enterprises, which is why *social trust* is a central factor, in addition to competition, in the interaction of small enterprises (Monsted, 1995).

Innovations, networks and the strategy of a firm

It is almost impossible to avoid using the concept strategy when investigating any business activity from the point of view of the firm, i.e. examining the firm as an active participant. This concept does not only apply to the explicit or implicit strategy of the firm, but it is also used when different areas of the business activities are examined (e.g. in studies of product strategy, market strategy, employment strategy). One can also examine different activities in relation to the strategy of the firm.

As mentioned above, both internal and external networks are important to firms' innovation activities (Harris et al., 2000). Networking is considered important to innovation activities not only for the exchange of knowledge and experiences but largely because networks reduce uncertainty and risks (Koschatzky & Muller, 1997). Jarillo (1988) associates networking strongly with the strategic behaviour of a firm. From the viewpoint of the strategic management of a company, it is essential to distinguish control activities, which the firm is able to manage, from non-control activities (Håkansson & Snehota, 1989). Linking networking to the strategic management of a firm focuses attention on the internal and external factors, which have importance on the effective operation of a firm, and which can be controlled.

In SMEs the firm's know-how usually coincides with that of the entrepreneur. In small firms the strategy is chosen by the entrepreneur, which has an effect on the organisation of the business activities of the firm. The know-how and attitudes of the entrepreneur can be assumed to influence both the organisation of the firm's activities and its management as well as its external relations (Borch & Arthur, 1995).

The strategy is connected to and adapts according to the life cycle of the firm (see e.g. Kimberly, 1981 and Porter, 1984). In simple terms: the strategy varies according to whether the firm is in the state of growth, even including, with certain provisions, the starting phase, or in maturity, or recession. Firms in dynamic growth seek a flexible resource, know-how and new ideas from networks (Rothwell & Dodgson, 1991). Conventional, stagnant firms, on the other hand, may emphasise cost factors: they are in co-operation in order to minimise costs. In fact, the connections between the life cycle of the firm and the firm's strategic choices are not that simple.

The know-how and habits of the firm (entrepreneur) can be assumed to guide the SME's choices. The idea of life cycle has also been used to illustrate the properties required from the entrepreneur (e.g. Bird, 1989) and the properties and choices made by the firm (Porter, 1984). These views are relevant, in particular, when studying small firms managed by entrepreneurs. At the starting phase, innovation and will to work are required from the entrepreneur. In the stage of maturity, it is important for the firm to succeed in the markets with the existing products and the entrepreneur must have the ability to control and manage the business.

2 Aims of the study

Our aim is to examine the effects which the local milieu has on the innovation activities of firms through empirical data. How does location influence the innovation processes of firms? What differences in innovation activities do SMEs in different locations have? Is innovation activity lower in rural areas than in firms located in towns or vice versa? Can firms located in rural areas compensate for an unfavourable position for lively innovation activity, as Vaessen and Keeble (1995) argue.

The hypotheses according to the liveliness of innovation activity in SMEs are as follows:

H0 = There are no regional differences in innovation activities of SMEs.

H1 = There are regional differences in innovation activities of SMEs: innovation activity is lower in rural areas than in towns or vice versa.

Furthermore, the innovation activity can be emphasised in different fields of business. In the growth branch innovation turns to the renewals that increase the turnover of the company, whereas the mature branch stresses innovations that improve cost efficiency (Niittykangas, 2002). The question is: are there any regional differences in innovation profiles? The hypotheses from this aspect are as follows:

H0 = There are no regional differences in firms' innovation profiles.

H2 = The innovation profiles differ between diverse regions: in developed urban areas innovations emphasise renewals that increase the turnover of the company and in rural areas they stress innovations that improve cost efficiency.

The changes in the competition environment and the development of technology require firms to have a strategic vision of innovation activity. The firms are compelled to make strategic choices in order to secure their competitiveness. The study of the innovation strategy of a firm can be based on the following three dimensions: aggressiveness, level of interaction, and intensity (among others, Zahra 1996; Llerena & Oltra 2002; Harris et al 2000; Kickul & Gundry 2002). As regards each dimension, firms can make different kinds of choices, but it can be assumed that a choice made regarding one dimension influences other strategic choices as well.

Factors influencing a company's innovation strategy can be sought in the characteristics of the firm, especially in its line of business, its size, the entrepreneur's/manager's personality and skills, and the milieu of the company. In this study we investigate mainly the meaning of the local milieu in the choices the firm makes regarding innovation strategies.

H0 = there are no regional differences in firms' innovation strategies.

H3 = the local environment of firms forms their innovation strategy.

This study focuses on whether any of the above-mentioned regional differences in SME innovation activity exists. First, in the third section, we present the empirical data and the regional classification used in this study. Then in the fourth section, we examine if there are differences in innovation activities between diverse regions. Modelling and variables are presented in the fifth section. The sixth section dissects

the empirical results concerning innovation activity estimations and discusses further needs for research.

3 Data and classification of regions

The target population of this study were small and medium-sized industrial and IC firms that operate outside growth areas (Helsinki, Turku, Tampere, Jyväskylä and Oulu). The sample of industrial firms was made by using stratified sampling: the sample was selected according to size categories.

The data consists of 295 enterprises, of which 253 were industrial firms and 42 were IC firms, which were interviewed by phone in March-April 2003. The interviews were carried out using a structured questionnaire.

Table 1 The data according to size and main line of business of firms

In this paper the regional units used are the municipalities. We have classified the municipalities into four categories according to rural typology (Keränen et al., 2000). The original typology includes five categories, but in order to carry out regional examination with data, two “town categories” were aggregated.

Table 2 Regional (rural typology) distribution of data

Regional differences regarding factors that contribute to innovation activity are statistically remarkable. Urban areas open up more possibilities to innovation activities than rural areas, for example, on the grounds of inhabitants’ education, R&D expenses, entrepreneurship, and the infrastructure of know-how. To what extent will these statistical differences be manifested in the business managers’ judgement of local environment? To what extent will these statistical differences be manifested in the business managers’ judgement of local environment? In Table 3 we use regional typology to compare respondents’ judgements of the local environment.

Table 3 Respondents’ attitude on operational environment by type of region

The respondents’ opinions of the local environment were measured by three sum variables: public services (5 items, cronbac alpha= .768), private services (7 items, cronbac alpha= .797), and entrepreneurship and connections (5 items, cronbac alpha= .558). The differences between types of region are statistically significant (.001), because the respondents’ opinions of sparsely populated areas were in contrast to those of other areas. We can, on the grounds of this result, presume that the dissimilarity of local environment could contribute to the (innovation) actions of small firms.

In the following sections, we test the set hypotheses in the front with the help of empirical data.

4 Innovation activity and local environment

Innovation activity in different areas

The precondition is that innovations are not equal in central areas and in the periphery. Therefore, it is useful to examine regional differences in innovation activities. In this study innovation activities are measured by two indicators: innovation activeness and innovation strategy¹.

Table 4 Innovation activeness and initiative in rural areas and small towns

Observed differences between regions were smaller than we had anticipated. It seems that innovation activity is somewhat more brisk in towns than in rural areas, but the regional differences are small and the differences are not statistically significant.

These results slightly support the presumption (H1) that firms' location in an unfavourable innovative milieu (Camagni, 1991; Maillat & Lecoq, 1992) necessitates low innovation activity. To some extent, this result sheds light on the underlying thought that local environment is an important factor for innovation activity or the firms located in rural areas cannot compensate for the weakness of local environment by working harder.

Innovation profiles in different areas

Our results above illustrate that SME innovation activity is very brisk in towns and relatively brisk in rural areas. Next we examine if there are regional differences in the emphasis of innovation activity. First, we look at how the firms have made innovations in different fields of business. Second, we examine the division of innovations into groups of two: the innovations that increase the turnover of the company (=output innovations) and the innovations that improve cost efficiency (=input innovations).

Table 5 Innovation profiles in different areas

In Table 5 we can see that the innovations of SMEs emphasised product and production innovations. The innovation profiles of SMEs are quite similar in every area in focus. We found a statistically significant difference between regions only in one field of business: organisation. Innovations related to organisation were more general for firms located in towns than firms located in rural areas. The reasons for this difference might derive from a complexity of organisation and/or doctrines of the organisation and management. We can presume that the local environment influences firms' organisation and the management of their operations.

We presuppose that firms located in rural areas often operate at mature branch and therefore their renewals were allocated to improve the cost efficiency. Growth branch operating firms, instead, were located in central areas. (Niittykangas, 1999)

¹ Innovation activeness is constructed from 6 items (cronbac alpha= 0,7108) and sum variable innovation strategy (initiative) include 4 items (cronbac alpha= 0,7288)

Table 6 Output and input innovations in different areas

In Table 6 we can see that the regional factor does not seem to influence the emphasis of innovation activity (H2). Regardless of location, small firms devote themselves to output innovations, especially to product innovations, more than to input innovations. The time when questioning was done may affect this result. During the first years of the opening decade of the twenty-first century, the economy was growing in Finland, and the companies in any branch benefit from the growth. In other words, we can think that regional factors have not had a presumed effect on input/output innovation activity.

5 Factors affecting innovation activity

Innovation strategy and local environment

The innovation strategy of a firm can be seen as a strategy concerning one sector of the firm's business activities (functional-level strategy). It is closely connected to the general strategy of the firm. The innovation strategy of a firm has been examined from different points of view. The factors influencing innovation strategy have been one object of interest. Another distinct research area is investigating the connections between different strategies and the success of the firm (Zahra, 1996; Llerena & Oltra, 2002). Often also a firm's networking and choices connected to it are seen as a strategy aiming at innovations (Julien & Lachance, 2001; Robertson & Langois, 1995).

When classifying the innovation strategies of firms, we can see two different starting points: one is the goal of the strategy, such as leader-follower; the other is the manner in which the goals are pursued, including internal and external learning processes, networking, and alliances (among others Zahra, 1996; Llerena & Oltra, 2002; Harris et al., 2000; Kickul & Gundry, 2002). The different starting points can also be seen as the two dimensions of the firm's innovation strategy. They can be complemented by measures carrying out the strategy, e.g. organising the R&D activities and resources, product and production portfolio, and anticipation system. These factors reflect how intensively a firm is devoted to innovation.

Figure 1 The dimensions of innovation strategy (Storhammar & Virkkala 2003b)

The innovation strategy of a firm can be examined empirically based on three basic dimensions: 1) initiative and anticipating, 2) internal and external networking interaction and 3) intensiveness (Storhammar & Virkkala 2003b). The companies can make different choices for each dimension, but it is supposed that a choice for one dimension also affects other strategic choices. To describe these basic dimensions of the strategy, four sum variables have been formed: initiative (4 items), resource allocation (6 items), inter-

nal interaction (6 items) and external networking (5 items).² In addition to these sum variables, there is a variable which describes the anticipating in the examination.

Table 7 Dimensions of innovation strategy in different areas

The averages for the different dimensions are quite near each other in the areas to be examined. The external networking does not rise in the town regions more than in rural areas. The difference in the networking can be naturally in the regional directing of these network relations. The internal interaction is a little busier in the companies of town regions than in the companies which are located in the rural areas.

The regional differences in innovation strategy and innovation activity are not statistically significant on the basis of the average tests. The scantiness of the regional differences of innovation activity and innovation strategy does not mean that the innovation activity in different environments would be identical. The regional differences in the innovation activity can be connected to the manner of the small and medium-sized companies to produce or to adopt innovations, to network, or to the birth of innovation chains in the company. Due to innovation chains, and the other factors, the distinguishing of profiles is covered over time: product innovation often leads to reforms in other sectors of the business and vice versa (for example, see Niittykangas et al., 2006). The examination of differences of this kind requires more sophisticated analysis methods. Next, the factors affecting firms' innovation activity are analysed via logistic regression analysis.

Variables used in logistic regression model

The description of the independent variables is presented in Table 8 and the means of variables of different groups in Appendix 1. The independent variables were measured in 2003, if not otherwise stated. The variables and their expected effects are briefly presented next.

Our data provide information on entrepreneurial and firm characteristics as well as on the firm's networking and regional characteristics. The explanatory variables used in this study are grouped into personal, firm, regional, and innovation strategy characteristics, including: intensiveness, initiative, and networking characteristics.

The variables describing personal characteristics include gender and trust. The variables describing a firm's characteristics include age, future outlook, technological level, export level, level of internationalisation, growth of sales turnover and market innovations. Danes et al. (2007) found that gender does not restrain the effects of innovations on gross revenue on family business context. It can be assumed that women have broadly similar behaviour to their male counterparts concerning innovation processes. Thus, gender does not change the effects of innovation processes. One explanation may be that innovation and innovation processes are defined by universal nomenclature and, moreover, the nature of innovation may be mainly driven by technology.

² Reliability of the items that have been used in the sum variables were (cronbach alpha): initiative= .7288, intensiveness= .7653, internal interaction= .7718 and external networking= .7882

Monsted (2005) argues that small enterprises emphasised personal contacts in their networking. Trust can be seen to allow large-scale firms to operate efficiently with low friction level (Lane & Bachmann, 1998). Concerning small and medium-sized firms, Tödtling and Kaufmann (2001) argue that interactions of SMEs are typically informal and trust-based. They resume that innovation concepts have changed towards an interactive design where innovation is considered to be an interactive process inside firms as well as with other firms. Interaction commonly includes trust-based relations that are permanent. Ståhle and Sotarauta (2003) rationalise that networks are the most significant function of the innovative environment, suggesting that functioning networks are created with close links between players, trust and multilateral dependency. As a consequence, the social trust is a central factor in the firm's interaction.

Table 8. Variable definitions (control group in brackets)

The variables related to firms cover the firm's age, technological level and export level. This suggests that the older firms have more resources to allocate resources to R&D. This can be persuaded by the path dependence connected with the ability to produce innovations at the firm level (see e.g. Lawson & Lorenz, 1999). It could also be assumed that the technological level is connected with innovation activity. According to Glasson et al. (2006), the defining characteristics of the high-tech sector include: involvement in innovative activity, R&D and technology intensity, high proportion of 'technology-oriented' personnel, high technology content (patents, licences and know-how) and leading-edge products or services. The high export level may indicate a firm also having more resources for R&D, and innovation activity is likely to be higher than in the case of low export activity. Studies have found a relationship between export and innovation activities in manufacturing. Wakelin (1998) found the number of past innovations has a positive impact on probability of an innovative firm exporting.

The innovation activity in firms whose sales turnover has grown rapidly, and whose internationalisation has been high, is assumed to be higher than in other firms. The future views of a firm's behaviour are controlled by the future outlook. Firms whose operations will remain constant or whose operations will decrease may not have as much resources for R&D as the high growth firms. Niittykangas (2002) states that in growth sectors innovations become the reshaping that increase the sales turnover of the firm. Moreover, mature sectors emphasise firms' cost efficiency, improving renewals, and innovations.

The local environment may affect a firm's networks and innovation activity. Audretsch & Feldman (2004) state that location and proximity matters in transmitting knowledge and exploiting spillovers, i.e. the productivity-enhancing impact of spillovers fades away quite rapidly with distance. Furthermore, innovative firms tend to locate in areas where there are resources that have accumulated along with the region's past success of innovation (see e.g. Feldman, 1994). As a consequence, towns offer a better environment for innovation activity and spillovers than sparsely populated areas.

The new economic geography (Ottaviano & Pinelli, 2004) suggests that agglomeration is more common in sectors characterised by stronger market power, faster innovation and rapidly changing products and tasks (hi-tech industries). As a consequence, firms of the same industry located in the same area may affect a firm's innovation activity.

Furthermore, firms of different industries may have a role in the innovation processes. For example, the so called knowledge-intensive business service (KIBS) firms are capable of fostering development and contributing to the growth of employment, income and productivity. They increasingly play a role of 'converters' of technological information within the economy as providers, purchasers or partners in the context of innovation. The KIBS firms act as an external knowledge source and contribute to innovations in their client firms. They also introduce internal innovations, provide highly qualified work opportunities and contribute to growth and economic performance (Muller & Zenker, 2001).

The significance of networks has grown in innovation processes. First, resources allocated to R&D, and networks, reflect how intensively a firm is devoted to innovation processes. We also analyse if market innovations are mainly based on a firm's own R&D. Second, the goal of the innovation strategy, such as leader-follower, is another very important issue. Third, the manners the goals are pursued play a very vital role in the innovation processes. Internal and external learning processes, local and global networks also reflect the firm's innovation activity (see Zahra, 1996; Llerena & Oltra, 2002). We also analyse a firm's innovation activity in relation to the firm's number of partners and intention for expanding networks.

Results

Table 9 presents the estimated coefficients together with their *t*-statistics and marginal effects.

Innovation activity is high vs activity is low

Our results show that the innovation activity of a firm is affected strongly by the growth of sales turnover. Firms with a decrease in their turnover were characterised by low innovation activity. Even the firms with a constant turnover had higher innovation activity compared to downward sloping firms. A probable explanation is that growth in sales turnover is based partly on innovations the firms are just entering on markets. Moreover, a firm's future outlook indicates the same result. If the firm's operations will grow strongly in the near future (3 years), its innovation activity will also be high. These results are in line with earlier studies indicating that in growth branches the innovations become the renewals that increase the sales turnover of the firm. (see e.g. Niittykangas, 2002)

Our study reveals that older firms have higher innovation activity compared to newly established firms. One possible explanation might be that the old firms have more resources to allocate to R&D. Their financial position may also be presumed to be better. The path dependence nature of innovation ability gives impetus to old firm innovation activity (see e.g. Lawson & Lorenz).

We found out that firms using a high level of technology in their production processes have high innovation activity. High technology sectors are characterised with involvement in innovative activity; R&D and technology intensity; high proportion of 'technology-oriented' personnel; high technology content, including patents, licences and know-how; and with leading-edge products or services. As a consequence, the high technology level may indicate a firm having more resources for R&D, and innovation activity is likely to be higher than in the case of low technology level. (see Glasson et al., 2006)

In the small towns, the innovation activity is high compared to sparsely populated areas. In towns a larger labour market exists that offers more job opportunities. Mobility of workers between firms allows knowledge to diffuse locally, creating spillovers supporting innovation action. Regional labour markets therefore become an arena where knowledge suppliers and users interact. Location and proximity matters in transmitting knowledge and exploiting spillovers, and this indicates that the productivity-enhancing impact of spillovers fades away quite rapidly with distance. (see e.g. Audretsch & Feldman, 2004). As a consequence, towns offer a better environment for innovation activity and spillovers than sparsely populated areas.

Table 9. Variables explaining innovation activity; coefficients, t-values, marginal effects. Logistic regression model, base outcome is innovation activity is low (=1)

We also discovered that firms of different industries located in the same area affect firms' innovation activity. These firms support development by working as providers, purchasers and partners in the context of innovation. Muller & Zenker (2001) argue that, for example, KIBS firms are capable of fostering development and contributing to the growth of employment, income and productivity by inter alia contributing to innovations in their client firms.

One interesting aspect connected with innovation activity is networking. First, the study showed that firms with larger local networks also have higher innovation activity. Second, firms with high initiative in creating networks had higher innovation activity compared to followers (low initiative firms). Moreover, firms with extensive external and internal networks have also higher innovation activity. These results are in line with the theory emphasising the goal of innovation strategy, such as leader-follower, and the manner in which the goals are pursued, including internal and external learning processes, and networking, are cornerstones of innovation strategy (see Zahra, 1996; Llerena & Oltra, 2002.).

5 Discussion and Conclusions

The primary aim of the current paper is to find out whether there are regional differences in innovation activity. We examined the effects the local milieu has on innovation activities of firms through empirical data. The observed differences between regions were smaller than we had anticipated. The innovation profiles in different areas are also fairly convergent. Can we draw the conclusion that innovation policy has been regionally successful? However, the fact that the growth areas of Helsinki, Tampere, Turku,

Oulu and Jyväskylä were not included in the data could influence our regional results. It is a well-known fact that R&D resources and public investments have concentrated in growth areas, in particular, in the Helsinki area (see e.g. Nivalainen & Mikkola & Tohmo, 2009).

The lack of local networking opportunities in more peripheral regions need not, by itself, hold back *innovation* in SMEs. One possible way to innovate is a process of interactive learning which comes about through *external* networking, beyond the boundaries of proximity. This *external* networking often depends on integration into national sector- or cluster-based innovation systems, which are structured within the context of the national innovation system. (Virkkala 2005.) Thus, the main point that separates innovation activity of firms located in different areas can be the firms' way to produce/adopt innovations.

Our study seeks to contribute to our understanding of firms' innovation activity. We examined the importance of a firm's age, technological level, sales turnover, location and networks. Our logistic regression model revealed factors affecting the firm's innovation activity.

The results of the study reveal that older firms have a higher innovation activity compared to newly established firms. The path dependence nature of innovation ability supports our results (see e.g. Lawson & Lorenz). Furthermore, networks are a very important part of the innovation processes and trust is a vital part of functioning networks. Thus, innovation interaction processes contain incessant trust-based interrelationships supporting the view that old firms have higher innovation activity. Old firms may also have more resources to allocate to R&D and their financial position may also be better.

Our study also implies that high-technology firms operate with higher innovation activity. Studies have found that high-technology firms are more active in product innovation, especially if products are new to the market (see e.g. Tödtling & Kaufmann 2001; Hassink, 1996). In addition, the growth branches' innovations are oriented to the renewals that increase the turnover of the company, whereas mature branches emphasise innovations that improve cost efficiency (Niittykangas, 2002). Generally speaking, high-technology sectors are characterised by involvement in innovative activity, R&D and technology intensity, have a high proportion of 'technology-oriented' personnel, high technology content, including patents, licences and know-how, and offer leading-edge products or services. As a consequence, the high technology level may indicate a firm also having higher innovation activity.

As mentioned earlier, innovations in growth branches turn to the renewals that increase the turnover of the company and mature branches stress innovations that improve cost efficiency (Niittykangas, 2002). Our results suggest that firms' innovation activity is affected strongly by the growth of sales turnover. Firms with decreasing turnover were characterised by low innovation activity. Furthermore, the firms with increasing or stable turnover had higher innovation activity compared to firms with a downward sloping turnover. The study also suggests that if the firms expect their operations to grow strongly in the near future (3 years), their innovation activity will be high.

The results also suggest that firms of different industries located in the same area affect a firm's innovation activity. This is in line with earlier studies which have found that the most important innovation partners for SMEs are the vertical business sector relations. Horizontal relations are found to be less frequent (see e.g. Hassink, 1996; Tödtling & Kaufmann, 2001). These firms support development by working as customers, suppliers and partners in the context of innovation. For example, the KIBS firms can contribute to innovations in their client firms.

One interesting outcome of the study is that firms with more extensive local networks also have higher innovation activity. Furthermore, firms with high initiative for creating networks also had higher innovation activity compared to followers. The results also show that firms with extensive external and internal networks also have higher innovation activity. Small and medium-sized enterprises are usually seen facing several barriers in their innovation processes and having low capacity for networking (see e.g. Tödtling & Kaufmann, 2001). It has also been shown (Littunen & Tohmo, 2003) that firms' external personal networks bring about competitive advantages, innovations and efficiency and, furthermore, these networks are of importance in achieving high growth.

At the regional level, our findings support the assumption that in small towns the innovation activity is higher compared to sparsely populated areas. Towns have more human capital, concentrations of business firms, institutions, developers, and employees. Towns are also more accessible than rural areas. Therefore, towns become an innovative arena where knowledge and spillovers are exploited. Thus, towns also offer a better environment for innovation activity and spillovers than sparsely populated areas.

Small and medium-sized firms are facing several innovation barriers. Consequently, SMEs have fewer networks than large firms. Usually they rely more heavily on regional networks. Tödtling and Kaufmann (2001) argue that research institutions, technology centres and technology transfer units do not play a very important role in SMEs' innovation processes. The role of the KIBS firms has grown since the year 2000. They have become an important node on innovation systems. They can contribute to the growth and productivity by contributing to innovations in their client firms. Technology centres and technology transfer units are used less by SMEs in their innovation processes than expected. There might be some barriers preventing the creation of functioning networks between SMEs and these support organisations. KIBS firms are usually small and medium-sized and they are kept very nimble. They are also expected to become more and more active and significant actors in SMEs' innovation processes in the future. This development could also be strengthened via support from the Ministry of Employment and the Economy.

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Appendix 1. Descriptive statistics, whole sample

VARIABLE	Whole sample n= 295
	Mean
Export (very high)	
• Very low	0.64
• Low	0.08
• High	0.14
• Very high	0.14
Gender	1.86
Trust (business trust is high)	0.48
• Business trust is low	0.52
Level of technology used (medium-high or high technology)	
• High level of technology	0.17
• Medium-high level of technology	0.12
• Medium technology	0.39
• Low level of technology	0.33
Sales turnover is based on sales from growth regions	30.41
Future outlook (high growth)	
• Operations will fall down slightly or more	0.04
• Remain the same	0.24
• Low growth	0.63
• High growth	0.09
Market innovations (mainly based on outside R&D)	
• Mainly based on firms own R&D	0.60
• Based on firms own and outside of firm both	0.31
• Mainly based on outside R&D	0.09
Establishment year (newly established)	0.11
• Old firm	0.88
Growth of sales turnover (low decrease or very high decrease)	
• Very high decrease	0.04
• Low decrease	0.06
• Remain the same	0.23
• High growth	0.41
• Very high growth	0.25
Local networks	2.83
Internationalisation	1.67
Wider networks	2.35
Firms of same industry located in the same area (very much)	
• Not at all	0.68
• Some	0.21
• Very much	0.11
Firms of different industries; supporting firms such as customers, suppliers etc. located area	
• Not at all	0.41
• Some	0.46
• Very much	0.13
Location of firms (sparsely populated areas)	
• Small towns	0.39
• Rural adjacent areas	0.13
• Rural heartlands	0.27
• Sparsely populated areas	0.21
Firm is a pioneer in creating networks (low or very low initiative)	
• Very low initiative	0.06
• Low initiative	0.22
• High initiative firm	0.47
• Very high initiative firm	0.26
Firm's external networks (low or very low external networks)	
• Very low external networks	0.19
• Low external networks	0.19
• High external networks	0.42
• Very high external networks	0.20
Firm's internal interaction (low or very low internal interaction)	
• Very low internal interaction	0.08
• Low internal interaction	0.29
• High internal interactions	0.51
• Very high internal interactions	0.13
Resource allocation to R&D (low or very low resources to R&D)	
• Very low resources to R&D	0.11
• Low resources to R&D	0.22
• High resource allocation to R&D	0.42
• Very high resource allocation to R&D	0.25

Table 1 The data according to size and main line of business of firms

Size category, employees	Firms	
	n	%
– 4	67	22,7
5 – 9	66	22,4
10 – 49	64	21,7
50 –	55	18,6
Industrial firms	252	85,4
IC firms	43	14,6
Total	295	100,0

Table 2 Regional (rural typology) distribution of data

TYPE OF REGION	NUMBER OF FIRMS	PERCENT
Small towns*	115	39,0
Rural adjacent areas	39	13,2
Rural heartlands	78	26,4
Sparsely populated areas	63	21,4
Total	295	100,0

*(103+12)

Table 3 Respondents attitude on operational environment by type of region

Type of region		Entrepreneurship and connections	Public services	Private services
Small towns	mean	3,4574	3,1809	3,3168
	n	115	115	115
Rural adjacent areas	mean	3,5784	3,3231	3,3480
	n	37	39	39
Rural heartlands	mean	3,4987	3,2077	3,3205
	n	77	78	78
Sparsely populated areas	mean	3,0571	2,9048	2,9184
	n	63	63	63
Total	mean	3,3973	3,1478	3,2368
	n	292	295	295

Table 4 Innovation activeness and initiative in rural areas and small towns

TYPE OF REGION	ACTIVENESS	INITIATIVE
Small towns*	2,6391	3,5109
Rural adjacent areas	2,5812	3,6282
Rural heartlands	2,3953	3,6923
Sparsely populated areas	2,4841	3,4524
Total	2,5339	3,5619

Table 5 Innovation profiles in different areas

Field of business	Small towns	Rural adjacent areas	Rural heartlands	Sparsely populated areas
Product	3,38	3,36	3,10	3,41
Production technology	2,86	2,72	2,83	3,05
Production system	2,68	3,00	2,54	2,38
Organization**	2,37	2,15	1,88	1,78
Marketing	2,56	2,21	2,03	2,32
Acquisition	1,99	2,05	1,99	1,97

**significant level 0, 01

Table 6 Output and input innovations in different kind of areas

	Small towns	Rural adjacent areas	Rural heartlands	Sparsely populated areas
Output innovations	2,9696	2,7821	2,5641	2,8651
Input innovations	2,4739	2,4808	2,3109	2,2937

Table 7 Dimensions of innovation strategy in different areas

Dimension of innovation strategy	Small towns	Rural adjacent areas	Rural heart-lands	Sparsely populated areas
Initiative	14,04	14,51	14,77	13,81
resource allocation	9,31	9,26	9,31	8,86
internal interaction	19,30	18,21	17,76	17,88
external networking	13,32	13,43	12,92	13,40
Anticipating	3,36	3,36	3,23	3,41

Table 8. Variable definitions (control group in brackets)

VARIABLES	DEFINITION
Export (very high) <ul style="list-style-type: none"> • Very low • Low • High 	Dummy: export share is very high (comp.); 1= export share is very low; 0= otherwise 1= export share is low; 0= otherwise 1= export share is high; 0= otherwise
Gender	1= woman; 2= man
Trust (business trust is high) <ul style="list-style-type: none"> • Business trust is low 	Dummy: business trust is high (comp.); 1= business trust is low; 0= otherwise
Level of technology used (medium-high or high technology) <ul style="list-style-type: none"> • Medium technology • Low level of technology 	Dummy: technology level used is medium-high /high (comp.); 1= technology used is medium level; 0= otherwise 1= technology used is low level; 0= otherwise
Sales turnover is based on sales from growth regions	Sales turnover is based on sales from growth regions (%)
Future outlook (high growth) <ul style="list-style-type: none"> • Operations will fall down slightly or more • Remain the same • Low growth 	Dummy: High growth of firm's operations (comp.); 1= operations will fall down slightly or more; 0= otherwise 1= operations will remain the same in the future; 0= otherwise 1= low growth of operations; 0= otherwise
Number of partners in corporation (high=over 9) <ul style="list-style-type: none"> • Number of partners are lower than 10 	Dummy: number of partners are 10 or more (comp.); 1= number of partners are lower than 10; 0= otherwise
Our firm is striving for expand of networking (agree very much) <ul style="list-style-type: none"> • Agree very little/ not at all • Agree little • Average agreement • Agree much 	Dummy: Agree very much that firm is striving for expand of its networking (comp.); 1= agree very little/not at all; 0= otherwise 1= agree little; 0= otherwise 1= average agreement; 0= otherwise 1= agree much; 0= otherwise
Market innovations (mainly based on outside R&D) <ul style="list-style-type: none"> • Mainly based on firms own R&D • Based on firms own and outside of firm both 	Dummy: market innovations mainly based on outside R&D (comp.); 1= mainly based on firm's own R&D; 0= otherwise 1= based on firms own and outside of firm R&D both; 0= otherwise
Establishment year (nearly established) <ul style="list-style-type: none"> • Old firm 	Dummy: firm is nearly established (comp.); 1= old firm; 0= otherwise
Growth of sales turnover (low decrease or very high decrease) <ul style="list-style-type: none"> • Remain the same • High growth • Very high growth 	Dummy: decrease of growth of sales turnover (comp.); 1= remain the same; 0= otherwise 1= high growth; 0= otherwise 1= very high growth; 0= otherwise
Local networks	Firms' local networks
Internationalisation	Internationalisation of a firm
Wider networks	Firms' global networks
Firms of same industry located in the same area (very much) <ul style="list-style-type: none"> • Not at all • Some 	Dummy: very much of the firms of the same industry located in the same area (comp.); 1= not at all; 0= otherwise 1= some; 0= otherwise
Firms of different industries; supporting firms such as customers, suppliers etc. located in the same area (very much) <ul style="list-style-type: none"> • Not at all • Some 	Dummy: very much of the firms of different industries such as customers, suppliers etc. located in the same area (comp.); 1= not at all; 0= otherwise 1= some; 0= otherwise
Location of firms (sparsely populated areas) <ul style="list-style-type: none"> • Small towns • Rural adjacent areas • Rural heartlands 	Dummy: sparsely populated areas (comp.); 1= small towns; 0= otherwise 1= rural adjacent areas; 0= otherwise 1= rural heartlands; 0= otherwise
Firm is a pioneer in creating networks (low or very low initiative) <ul style="list-style-type: none"> • High initiative firm • Very high initiative firm 	Dummy: low or very low initiative of firm (comp.); 1= high initiative firm; 0= otherwise 1= very high initiative firm; 0= otherwise
Firm's external networks (low or very low external networks) <ul style="list-style-type: none"> • High external networks • Very high external networks 	Dummy: low or very low external networks (comp.); 1= high external networks; 0= otherwise 1= very high external networks; 0= otherwise
Firm's internal interaction (low or very low internal interaction) <ul style="list-style-type: none"> • High internal interactions • Very high internal interactions 	Dummy: low or very low internal interaction (comp.); 1= high internal interactions; 0= otherwise 1= very high internal interactions; 0= otherwise
Resource allocation to R&D (low or very low resources to R&D) <ul style="list-style-type: none"> • High resource allocation to R&D • Very high resource allocation to R&D 	Dummy: low or very low resource allocation to R&D (comp.); 1= high resource allocation to R&D; 0= otherwise 1= very high resource allocation to R&D; 0= otherwise

Table 9. Variables explaining innovation activity; coefficients, t-values, marginal effects. Logistic regression model, base outcome is innovation activity is low (=1)

VARIABLE, innovation activity (1=low; 2=high)	Coefficient	t-statistic	Marginal effect
Export (extra high)			
• Very low	-0.641	-0.76	0.527
• Low	-0.530	-0.46	0.589
• High	-0.873	-1.20	0.418
Gender	0.416	0.73	1.517
Trust (business trust is high)			
• Business trust is low	0.321	0.87	1.378
Level of technology used (medium-high or high technology)			
• Medium technology	-0.364	-0.79	0.695
• Low level of technology	-0.948*	-1.87	0.387
Sales turnover is based on sales from growth regions (%; continu)	0.008	1.27	1.008
Future outlook (high growth)			
• Operations will fall down slightly or more	-0.065	-0.06	0.937
• Remain the same	-2.410***	-3.00	0.090
• Low growth	-0.614	-0.98	0.541
Number of partners in corporation (high=over 9)			
• Number of partners is lower than 10	-0.579	-1.22	0.560
Our firm is striving for expand of networking (agree very much)			
• Agree very little/ not at all	1.248	1.07	3.485
• Agree little	1.341	1.13	3.821
• Average agreement	1.202	1.24	3.327
• Agree much	0.881	1.13	2.414
Market innovations (mainly based on outside R&D)			
• Mainly based on firms own R&D	0.272	0.42	1.313
• Based on firms own and outside of firm both	1.020	1.50	2.774
Establishment year (newly established)			
• Old firm	1.238**	2.00	3.449
Growth of sales turnover (low decrease or high decrease)			
• Remain the same	2.513***	2.73	12.343
• Low growth	2.623***	2.96	13.780
• High growth	2.205**	2.55	9.074
Local networks	0.818***	2.92	2.267
Internationalization	0.093	0.25	1.098
Wider networks	-0.318	-1.00	0.727
Firms of same industry located in the same area (very much)			
• Not at all	0.369	0.53	1.446
• Some	-0.267	-0.35	0.765
Firms of different industries located in the same area; supporting firms such as customers, suppliers etc. (very much)			
• Not at all	-1.011	-1.48	0.364
• Some	-1.123*	-1.72	0.325
Location of firms (sparsely populated areas)			
• Small towns	0.996*	1.86	2.707
• Rural adjacent areas	0.736	1.09	2.088
• Rural heartlands	0.072	0.13	1.075
Firm is a pioneer in creating networks (low or very low initiative)			
• High initiative firm	0.963*	1.79	2.619
• Very high initiative firm	1.377**	2.36	3.962
Firm's external networks (low or very low external networks)			
• High external networks	-0.377	-0.53	0.686
• Very high external networks	2.042*	1.90	7.707
Firm's internal interaction (low or very low internal interaction)			
• High internal interactions	1.490***	3.03	4.436
• Very high internal interactions	-0.564	-0.72	0.569
Resource allocation to R&D (low or very low resources to R&D)			
• High resource allocation to R&D	0.030	0.06	1.031
• Very high resource allocation to R&D	0.732	1.26	2.079
Constant	-7.435***	-2.87	
Significant *, **, *** at 10, 5, 1% levels,	N=259; LR chi2(34)= 111.36; Log likelihood=-108.23586; Prob chi2= 0.0000, R2= 0.3397		

Figure 1 The dimensions of innovation strategy (Storhammar & Virkkala 2003b)

