International Journal of Industrial Engineering and Management (IJIEM), Vol. 4 No. 2, June 2013, pp. 57 – 67
Available online at www.iim.ftn.uns.ac.rs/ijiem_journal.php
ISSN 2217-2661

Research paper

Strategic Innovation Development Based on Systems Research in a Rural Region

Minna Sarkkinen
PhD student, School of Industrial Engineering and Management, Lappeenranta University of Technology, 53850 Lappeenranta, Finland, minna.sarkkinen@dnainternet.net

Tuomo Kässi
Professor, School of Industrial Engineering and Management, Lappeenranta University of Technology, 53850 Lappeenranta, Finland, tuomo.kassi@lut.fi

Received (06 February 2013); Revised (20 May 2013); Accepted (27 May 2013)

Abstract

Strategic thinking is required to account for the different dimensions of strategic innovation management. The study builds and analyses three viewpoints of strategic innovation management, i.e. innovation environment, value delivery and innovation capability, in the context of a regional innovation system. The aim is to study how the different dimensions describe innovation situation and development needs in firms and at regional level. The data for the study was collected during 2011 in a remote rural region located in Finland. The logic of purposeful sampling was used in the selection of the 50 firms. Soft systems methodology is applied as a systems research methodology and exploratory factor analysis is used as a method to analyze the three dimensions. The findings of the study identify several factors forming the three dimensions, which may have structural connection with each other. The factors highlight, e.g. the importance of networking capability and marketing related goals of innovation.

Key words: *strategic innovation management; regional innovation system; value delivery; innovation capability; innovation environment; soft systems methodology*

1. INTRODUCTION

Strategic thinking concerns besides firms also regional decision-makers. Lack of strategic thinking has been identified to as one of the biggest shortcomings in firms [7]. It has been also stated that there is a need for improved capacity for strategy development at regional level in many European regions [34]. Moreover, the OECD [22] argues that strategy setting requires commitment from all actors, political courage in the selection of priorities, founding on evidence, and information from multiple sources. Strategic thinking can support firms in gaining competitive advantage through finding means for how to be different from competitors, identification of alternative options to generate customer value, finding new opportunities, being future-oriented and considering options for collaboration, including how to co-create value with customers [1]. Strategic thinking involves holistic understanding of the firm and its environment, creativity and vision for the future [7], indicating a need for the systems approach. The connection between strategic thinking and the systems approach is supported also by Zahn [36], who states that strategizing needs, in addition to strategic planning, also strategic thinking, which is basically systems thinking. According to Senge [27], a holistic understanding involves the ability to see the connections between problems and their effects, which is characteristic for systems thinking. Hence, it can be concluded that strategic thinking is required to account for the different dimensions of strategic innovation management. Furthermore, holistic thinking requires the systems perspective, which justifies the use of the systems research approach in studying regional innovation system (RIS). Strategic thinking is seen also as a developmental learning process [16], which supports the use of soft systems methodology in development of regional innovation system (RIS). Inefficient systems thinking and lack of a comprehensive systems perspective can be seen to be a typical problem in strategic approaches, which have been either-or thinking, where either the environment or capabilities of a firm form the central point [33]. This is linked to the approaches of outside-in and inside-out to strategy, i.e. the question of whether firms should adapt themselves to the requirements of the environment or vice versa. According to Vos [33], the principal problem is that the environment and the firm are considered as separate parts, forgetting the fact that the environment and the capabilities of a firm have no meaning alone, only in respect to each other. The either-or approach can be seen behind most strategic approaches, and it is also supported by the definition on environmental

opportunities/threats and organizational strengths/ weaknesses (SWOT).

In this study, the principal problem is limited to a region and the economic growth (value delivery) of the region and the firms in the region. The development of innovation capability is considered as a central issue for the improvement of the innovativeness of the firms and the region. The issue is an interest to the regional decision makers, and thus the aim of the study is to provide information for regional strategic planning. Regional differences in innovation require tailored decision making and tailored political actions, i.e. there is no one-size-fit-all policy portfolio [18, 10, 35, 22]. A prerequisite for the customizing of a policy portfolio for regional specific features is understanding the specific innovation development needs of firms and opportunities for innovation support [18, 21].

2. THEORETICAL CONTEXT

Strategy can be determined as a relationship between means and objectives in order to find harmony between the human, political, economic and technological dimensions of the whole system [29]. According to Andrews [3], the purpose of strategy is to focus on customer value and long-lasting success of firms. The realization of strategy can be described with strategic orientation and strategic domain, where the strategic domain represents the interconnection between the firm and its business environment, dealing with the capabilities of the firm and its business opportunities, while strategy orientation focuses on the relationship of the firm and the environment over time [3].

The purpose of strategic management is not to establish the right solution, but to understand a complex and uncertain future [13]. For example, according to Abraham [1] strategic thinking means identification of alternative viable strategies or business models that deliver customer value. According to Liedtka [16], strategic thinking is a particular way of thinking that comprises elements of the systems perspective, intent focused thinking, intelligent opportunism, thinking in time, and hypothesis-driven thinking.

2.1 **Systems perspective**

Strategic thinking and a complex problem situation support the use of the systems perspective. The core concepts of systems thinking include a holistic perspective, seeing human thinking and knowledge as a cognitive system, and seeing boundaries based on different perspectives [30]. Causal relationships are an integral part of the systems perspective. According to Stacey [30], considerations on causal relationships have on impact on strategic decision making and strategic thinking has an impact on change. It is known that the structure of the system influences the behavior of the system, and it can create unintended results when including negative or positive feedback loops [30]. It has been noticed by experts on system dynamics that causal effects can be distant in time and space and that some points in the system can have strong leverage effect, i.e. identification of these leverage points and making change in them can have strong impact on the behavior of the system [30]. This indicates the importance of trying to identify causal relationships and leverage points in the problem situation to be able to target the policy instruments and improvements at these points.

The ideology of the self-referential theory, originally developed by the German sociologist Niklas Luhmann (1927-1998), proposes the use of the both-and approach to strategy, which accounts for both the environment and the firm. The theory sees social systems as self-referential systems, where strategic sense-making is based on self-reference, and every system has its own environment. This differs from the open systems theory, where the systems and the environment are seen inclusive, and which is behind the paradigm of adaptation. A self-referential system is not a part of the environment, but has its own environment in the world “Welt”. “Welt” refers not to “Welt an sich”, but to “Welt für mich”, i.e. it does not refer to the ontological concept of social reality but to the definition of the social system based on the system-environment distinction of each social reality. Self-reliance systems are autonomous in relation to their environment, which means that adaptation towards the environment is possible only through self-adaptation, and strategic sense-making means thus seeking solutions to problems between the firm and its environment through self-reference [33]. Innovation systems have been compared to general concepts of systems, although some researches argue that innovation systems cannot be created or developed by policy makers [5]. For instance, Bathelt [5] has criticized the existence of RIS as a self-referential system, referring to the definition of social systems by Luhmann. According to Bathelt [5], a RIS cannot be a self-referential system because it is highly dependent on national institutions in addition to other external impacts and lacks sufficient policymaking competences. In this study, firms are considered as self-referential systems, which apply both-and approach to strategy.

In the strategic management model presented by Vos [33], the environment of the firm is represented by choices regarding the business, vision and tactics. The organizational choices concern issues related to performance, assets and competence [32]. Movement between the environment and the firm (outside-in) needs connections between competitive moves and responsible internal functions and movement from inside-out needs linking between the operations and the business. The main questions are: what is the ability of the firm to do business with its customers as it has planned (outside-in), and on the other hand, what is the ability of the firm to develop its competences through competitive moves as planned (inside-out) [32]. Hence, the question is how to support firms in developing their competences through competitive moves and the ability to do business with their customers. Additionally, considering firms as self-referential systems emphasizes the need to diagnose innovation

development needs at the firm level and use of the bottom-up approach instead of the top-down one.

The summary of some references which describe the claimed connections between the three dimensions is presented below.

The influence of the innovation environment to the innovation capability and value delivery of the firms:

- environmental factors are important factors affecting the innovation operations of firms [24],
- significant determinants affecting innovation in firms are the firm structure, including flexibility and size, region and location, networking, knowledge acquisition, and public policies, and the surrounding culture, including external financial support to innovation [6], and
- innovation services are actions which support the innovation processes of firms [26].

The influence of the innovation capability to the value delivery of the firms:

- Prahalad and Krishnan [31] highlight the role of organizational capabilities in the development of innovations and value,
- capabilities refer to the capacity of a firm to utilize the resources owned or controlled by a firm in order to achieve its objectives [2], and
- innovation capability can be defined as the capability to utilize existing resources and competences in order to create competitive advantage through innovation [11].

The influence of the value delivery to the innovation environment:

- firms and other organizations have very diverse characteristics regarding innovation, and these characteristics influence the innovation environment and innovation system [31]. Factors of this kind are for example: the market dependency of firms on some actors in the value chain, like customers, which can increase the incremental nature of innovations, firm size, innovation types, innovation objectives, innovation sources, and the locus of innovation activities [15].

The analytical framework of the research is based on the three main dimensions of innovation management. The innovation environment includes a variety of actors, such as different authorities, financing instruments, structural and economic factors. The value delivery dimension means value identification, value creation and communication of value for customers, besides value for other shareholders and parties. The innovation capability dimension includes the capacity to deploy the different tangible and intangible resources required for value delivery. The goal of the study is to answer the research questions:

How do the three dimensions identify the innovation situation of the firms in the region? and
What are the most important factors behind them?

3. RESEARCH DESIGN AND DATA

The study was conducted during 2011 in the region of Pielinen Karelia located in Eastern Finland. The empirical data is based on the CoCo-project administrated by Karelia University of Applied Sciences, the purpose of which was to advance innovation development of the firms in the region. The data is based on a survey including 50 firms located in the region.

The logic of purposeful sampling was used in the selection of the 50 firms in order to find the most typical firms. The objective of purposeful sampling is to select information-rich samples for a closer study to learn more from the central issues under study [23]. The purposiveness in this study was based on typical case sampling based on certain criteria: the firms had to have a need or an interest to develop their products or operations. The object was to find especially those SMEs whose own innovation capability was insufficient to utilize the internal and external resources needed for innovation development.

Most of the firms (61%) were micro size enterprises (employing less than 10 persons, with a turnover of less than 2 MEUR). The share of small firms (employing less than 50 persons with a turnover of less than 10 MEUR) was 18%, and the rest were medium size or large firms (21%). The firms were mainly manufacturing organizations (67 %) and 33% represented the service sector. The manufacturing firms represented mainly metal industry (20%) or wood industry (16%). The firms representing the service sector were mostly from the social and health care sector (10%) and tourism sector (10%).

3.1 Systems research and soft systems methodology

Soft systems methodology (SSM) was originally introduced by Peter Checkland in 1981 [8]. Methodology in SSM refers to different methods and techniques, which are applied according to the needs of the situation, i.e. methodology is at a meta level in relation to methods [4]. Soft problems can concern, e.g. questions of the performance of the system or how to improve the system. The purpose of SSM is not to analyze existing systems, but to apply systems principles to structure thinking [4]. SSM is characterized as a systemic process of enquiry that uses system models [9]. Quantitative methods focus on system technological approaches aiming to analyze and describe a technical phenomenon, while qualitative SSM deals with complex organizational problems with social, political and human activity elements [4], which is typical for innovation systems. Qualitative system analysis is also known as the systems strategic approach, which has the aim to produce different decision and action strategies in a given situation and to analyze their impacts [4]. Also, according to Checkland [9], SSM is related to the management process, including the reaction to changes.

SSM uses human activity systems (HAS) called holons, which consist of interlinked activities and components that together meet the requirements of the core system [8]. A HAS has a purpose, it has a measure of performance, it contains a decision making process, it has sub-systems, interactive components, a boundary, resources, some continuity, and it exists in wider system(s) [8].The requirements of the HAS are met by a regional innovation system. In this study, the system is restricted spatially to the region of Pielinen Karelia. The function of the system in this study is defined as innovation development and value delivery. The regional system includes several sub-systems, e.g. based on sectoral clusters, and it is part of larger systems, such as the national innovation system. The rationale for the use of SSM stems from the regional context and the aim to improve the innovativeness of firms. This refers to the purpose of realistic evaluation, which usually means evaluating the functionality, efficiency, productivity and effectiveness of a system in order to develop the processes [4]. Additionally, SSM highlights the significance of the autonomic operation of individuals or groups [9], which is in line with theory of self-referential systems by Luhmann [17]. Furthermore, SSM emphasizes the learning perspective and a system as a human operation system [9].

Checkland [9] defines two modes to apply SSM. The first mode is a formal step-by-step procedure known as intervention. The second way, known as interaction, is to use SSM as a thinking style without operating the stages. The modes are not alternatives, and they are typically mixed, as is done in this research. Furthermore, Checkland defines five constitutive rules for SSM, which together with the special language used in the process determine the use of SSM as follows:

1) SSM focuses on a real–world problem and aims to find improvement for the situation.
2) SSM is based on systems thinking.
3) SSM assumes that the real world is not systematic and makes a distinction between the everyday world and systems thinking about the real world. SSM constructs holons (human activity systems), which are used to enquire or interrogate the real world in order to propose changes for improvements.
4) SSM has to be adapted to a particular situation.
5) SSM is a methodology, not a technique.

3.2 **Exploratory factor analysis**

Factor Analysis provides a technique for the analysis of common variation of several variables at the same time. The purpose of the factor analysis is to find out how correlations of variables operate together, i.e. which variables are dependent from each other. Factor analysis can be either confirmatory (CFA) or exploratory (EFA). Exploratory factor analysis was used in this study.

Factors are combinations of variables which have similar variation with each other but which are independent from other variables, i.e., factors represent latent variables. Factor analysis is based on a correlation matrix between variables. The purpose is to form a mathematical model through the factors which can produce the original correlation matrix. The difference between the two matrices is a correlation matrix of residual terms that includes the common variation which is not possible to explain through factors, i.e., in the optimal case the residual term matrix should contain as small numbers as possible [20].

Factor analysis provides better reliability with larger sample sizes because fluctuation of correlation coefficients. However, recommendations on minimum sample size vary. In this research, the purpose is not to generalize the results outside the firms and the region, so the question about the representativeness of the total population is less significant. Furthermore, the data should have sufficient inter-correlation between the variables. Too high correlations can cause multicollinearity. It is recommended to eliminate variables with very low (<0,3) or very high (>0.8) correlations from the matrix. Bartlett's test of sphericity indicates sufficient correlations in the correlation matrix. Additionally, measure of sampling adequacy (MSA) indicates appropriateness of intercorrelations. Multicollinearity can be checked through determinant of the R-matrix which is recommended to be over 0,00001 [12].

Loadings of factors are a type of regression coefficients indicating explanative power of each variable. High factor loadings indicate good convergent validity. Higher absolute value of the loading between a factor and a variable explains better the variation of a variable. Extraction means mathematical method that determines factors and their loadings to variables. The extraction method aims to form independent linear combinations from identified variables where variation of one group of variables (y2, y3, y4) explains variation of some other variable (y1). Thus, the analysis is based on grouping of variables with similar variation. Rotation is used to make interpretation of the factor solution easier. Rotation changes the loading structure in order to maximize the loadings of one variable to one factor and in order to minimize the loadings to other factors [20].

Eigenvalues of factors describe explanative power of individual factors in terms of entire material. Higher eigenvalues indicate higher significance from the viewpoint of the solution. The power of the explanation of each factor is typically expressed as percentages of variances. Communalities describe the explanative level of each variable in terms of all factors. Communalities indicate how well the variables represent the model. Good factor analysis explains common variation as much as possible with as low amount of factors as possible. Additionally, good factor solution consists of factors either very high or very low absolute values of loadings. There should be meaningful interpretation for the contents of each factor. Usually, a prerequisite for successful factor analysis is high number of research data including preferably several hundred observations. Additionally, relationships between the variables should be linear

and variables should be normally distributed. The suitability of the research material for factor analysis, i.e. statistical validity can be evaluated through Kaiser-Meyer-Olkin Measure (KMO) of sampling adequacy (recommended minimum > 0.50) and Bartlett's test of sphericity (recommended significance > 0.05). KMO is a generally used method for evaluation of intercorrelations among the variables [20].

4. FINDINGS

4.1 Factor analysis of results of innovation environment

The analysis started with studying of intercorrelations between the variables. Variables with very low correlations (<0,3) and very low measure of sampling adequacy (MSA) were removed. Very high correlations were eliminated so that the determinant of the R-matrix was higher than 0,00001 in order to avoid multicollinearity. The correlation matrices were optimized according to the overall Kaiser-Meyer-Olkin of sampling adequacy (KMO) and Bartlett's test of sphericity so that the factor analysis was appropriate. The analysis was conducted and number of factors was chosen by selecting factors with Eigenvalues over 1 as recommended by Kaiser (1974). Varimax rotation with Kaiser normalization was used in order to improve interpretability of factors. Principal component analysis was used as an extraction method. Only factor loadings over 0.4 were accounted in the output. SPSS 20.0 software was used in the analysis.

The factor analyses extracted nine factors for further analysis which are labeled as presented in Table 1. The factors explain together 78% of total variance. The sampling adequacy was 0.5 according to KMO measure and significance according to Bartlett's test of sphericity was good ($p<0.001$). KMO value was low but this was expected due to small sample size. Communalities of variables were above 0.6. Communalities, total variance explained and details of rotated component matrix are described in Table I-III (Annex 1). The first factor E1 in Table 1 comprises four variables where the lowest loading is 0,5. Three of the four variables concern clearly marketing and thus the factor was labeled as *Marketing goals*. The forth variable out of four concerns own financing capability and it has the highest loading. The variable reflects high correlation with financial capability and marketing goals. The second factor was labeled as *Own innovation activities* because it consists

Table 1. Factors representing innovation environment.

Code	*Factor label and variables*	*Eigenvalue*	*% of variance explained*	*Cumulative % of variance explained*
E1	**Marketing goals** • goal to get to new markets, • goal to grow markets, • importance of marketing innovations, and • own financing capability as innovation barrier	2.7	13.5	13.5
E2	**Own innovation activities** • importance of own R&D, • collecting ideas from customers, • importance of market research, and • importance of customer needs research	2.6	13.2	26.7
E3	**Production improvement** • improvement of quality, and • improvement of production flexibility	2.4	12.0	38.7
E4	**Used idea sources** • customers as idea sources, and • collecting ideas from personnel	1.9	9.4	48.0
E5	**Marketing and service innovations** • importance of service innovations, and • importance of marketing innovations	1.7	8.5	56.5
E6	**Lack of time** • lack of time as barrier to innovation, and • low need of commercial support	1.3	6.5	63.0
E7	**Outsourcing R&D** • high importance to outsource R&D, • lack of knowledge on markets, and • low use of customer need research	1.2	6.1	69.0
E8	**Financial barriers** • lack of financial support as barrier to innovation, and • lack of knowledge on markets	1.2	5.8	74.9
E9	**Product innovations** • importance of product innovations, and • goal to get to new markets	1.0	5.1	78.0

of four variables all dealing with own innovation activities. The third factor was labeled as *Production improvement* because it combines two variables dealing with production. Factor E4 was labeled as *Used idea sources* because it includes two variables dealing with use of customers as idea sources and collecting ideas from personnel. Factor E5 was labeled as *Marketing and service innovations* because it combines importance of service and marketing innovations. Factor E6 was labeled as *Lack of time*. The factor combines lack of time as barrier to innovation and low need of commercial support referring to common characteristics of firms which do not have problems with unused production capacity. Factor E7 was labeled as *Outsourcing R&D*, because it loads highest for outsourcing R&D, for lack of knowledge on markets, and low use of customer need research. Factor E8 combines lack of financial support as barrier to innovation with lack of knowledge on markets, and it was labeled as *Financial barriers*. Factor E9 combines importance of product innovations with goal to get to new markets, and it was labeled as *Product innovations*.

4.2 **Factor analysis of value delivery dimension**

The optimized correlation matrix included 10 variables and the factor analysis extracted four factors. Overall KMO value was 0.5 and significance was good according to Bartlett's test of sphericity ($p<0.001$). The lowest communality was 0.6. Communalities, total variance explained and details of rotated component matrix are described in Table IV-VI (Annex 1).The factors were labeled as described in Table 2.

The first factor comprises three variables which deal with product development, time horizon 2 (building emerging business) and radical or moderate grade innovations. Thus, the factor V1 was labeled as *Product development*. Factor V2 was labeled as *Needs of identification phase* because it combines three variables all dealing value identification phase. The third factor combines needs for technical services and services of university of applied sciences (UAS), and it was thus labeled as *Technical services of UAS*. Factor V4 consists of three variables combining micro firms, needs of cooperative partners and time horizon 2. The factor was labeled as *Partner needs of firms.*

4.3 **Factor analysis of innovation capability**

Totally 7 factors were extracted which represented approx. 78% of variance. Overall KMO was 0.5 and significance according to Bartlett's test of sphericity was good ($p<0.001$). The lowest communality was 0.7. Communalities, total variance explained and details of rotated component matrix are described in Table VII-IX (Annex 1). The factors were labeled as described in Table 3.

The first factor combines four variables with loadings between 0.5 and 0.9. The factor was labeled according to *Networking capability* consisting of variables dealing with ability to create partnership, capability to utilize networks, capability to utilize innovations developed elsewhere, and capability to create new successful business. The second factor was labeled as *Marketing capability*, because it consisted of five variables including capabilities to move to new markets, capability to find new markets, capability to create new successful business, capability to identify new business opportunities, and capability to evaluate innovation risks. The third factor was labeled as *Business renewal capability* because it included capability to identify new business opportunities, capability to catch new business opportunities, own networking activity and capability to improve current products and services. Factor C4 combines three variables regarding risk taking and it was thus labeled as *Risk taking capability*. Factor C5 was labeled as *Knowledge finding capability* because it consisted of variables of capability to find the latest knowledge and capability to utilize the latest knowledge besides capability to improve current products and services. Factor C6 was labeled as *Idea generation capability* combining two variables dealing with capability to produce new ideas for the business and capability to develop new different innovations.

Table 2. Factors representing value delivery.

Code	*Factor label and variables*	*Eigenvalue*	*% of variance explained*	*Cumulative % of variance explained*
V1	**Product development** • product development, • time horizon 2 (building emerging business), and • radical or moderate grade innovations.	2.2	22.3	22.3
V2	**Needs of identification phase** • needs for idea generation services, • needs of value identification phase, and • needs for commercial innovation services	1.9	18.9	41.2
V3	**Technical services of UAS** • needs for technical services, and • services of university of applied sciences.	1.3	12.7	53.9
V4	**Partner needs of firms** • micro size firms, • needs of cooperative partners, and • time horizon 2(building emerging business).	1.2	12.2	66.1

Table 3. Factors representing innovation capability.

Code	*Factor label and variables*	*Eigenvalue*	*% of variance explained*	*Cumulative % of variance explained*
C1	**Networking capability** • ability to create partnership, • capability to utilize networks, • capability to utilize innovations developed elsewhere, and • capability to create new successful business	4.6	24.4	24.4
C2	**Marketing capability** • capability to move to new markets, • capability to find new markets, • capability to create new successful business, • capability to identify new business opportunities, and • capability to evaluate innovation risks	2.7	14.4	38.8
C3	**Business renewal capability** • capability to identify new business opportunities, • capability to catch new business opportunities, • own networking activity, and • capability to improve current products and services	2.3	12.0	50.7
C4	**Risk taking capability** • will to take innovation risks, • capability to take innovation risks, and • capability to evaluate innovation risks	1.6	8.2	58.9
C5	**Knowledge finding capability** • capability to find the latest knowledge, • capability to utilize the latest knowledge, and • capability to improve current products and services	1.2	6.5	65.4
C6	**Idea generation capability** • capability to produce new ideas for the business, and • capability to develop new different innovations	1.2	6.3	71.6
C7	**Agility and capability to increase sales** • capability to increase sales in current markets, and • capability to change business operations quickly	1.1	5.8	77.4

The final factor was labeled as *Agility and capability to increase sales* and it combined two remaining variables, i.e. capability to increase sales in current markets and capability to change business operations quickly.

5. CONCLUSION

It is known that innovativeness of firms can significantly contribute to the economical development of regions. As a result, characteristics that influence the innovation development are an interesting area of research. This article attempts to study the various dimensions of strategic innovation management through systems approach and exploratory factor analysis to provide comprehensive picture on the innovation situation of the firms within one region. In general, the results extend and deepen the understanding on innovation development needs at firm level and their links to the value delivery process, innovation capability and innovation environment.

The paper discusses some common problems of policy-making regarding strategic innovation management and lack of systems approach. The article presents three specific aspects of strategic innovation management, which should be accounted in regional policy-making. Furthermore, the paper introduces the results of the study carried out within a region in order to develop understanding on the most important factors influencing innovation in firms. The empirical study identifies the factors regarding each dimension, which should be considered in the regional policy-making to improve innovativeness and competitiveness of the firms and the region in question.

In this study, the factors emphasize the potential roles of networking capability, marketing capability, and business renewal capability in the dimension of innovation capability, importance of marketing goals and own innovation activities in the dimension of innovation environment, and innovation development needs regarding product development in the dimension of value delivery. In the dimension of innovation environment, factors emphasize the importance of marketing related goals of innovation and their connection to financial barriers to innovation. In addition, the role of own R&D activities is highlighted with collecting ideas from customers. The factor concerning *Own innovation activities* is reflected in the factor of *Product development* in the value delivery

dimension. *Networking capability* in the dimension of innovation capability reflects *Partner needs of firms* in the value delivery dimension and *Marketing capability* reflects *Marketing goals* in the dimension of innovation environment.

Referring to the literature review [e.g., 24, 25, 31], this would mean that importance of marketing-related goals of innovation and own innovation activities indicate marketing, networking, and business renewal capability of firms, in addition to innovation development needs regarding product development. Thus, policy instruments should support own innovation activities and marketing goals of innovation in this case. Furthermore, the results would mean that networking, marketing and business renewal capability of firms indicate value delivery ability of firms, which further influence innovation environment.

It should be noted that the study is limited to concern one region only, which is rural and remote in nature. In addition, the firms were purposefully selected, comprising firms with need and interest for innovation development and which needed support in finding suitable external resources. This limits generalization of the results outside the region in question. Moreover, the relative small sample size limits extensive statistical analysis including all the factors and their causal relationships. However, the study provides further insight on various viewpoints concerning innovation management and an example on the comprehensive conceptual model and methodological approach, which can also be used in other regions. It would be recommended to apply the methodology with a larger sample size and include statistical research on structural causal mechanisms (structural equation modeling) between the identified factors.

The results provide information for regional decision-makers, educational institutes, firms, development agencies and other actors for the development of targeted strategies, interventions, policy instruments, innovation services and innovation systems. Innovation policy concerns all actors in the system, including firms (production structure), research organizations and educational institutes (knowledge infrastructure) besides policy actors, which represent the support structure [19].

The results emphasize need to develop innovation capabilities related to networking and marketing, i.e. the innovation environment should support the innovation operations of the firms especially in terms of networking and utilization of innovations.

From the perspective of strategic thinking, the use of different dimensions supports the creation of a holistic perspective on the situation and understanding of interaction between the parameters and dimensions. This provides information for the development of the regional innovation system and innovation environment, including policy instruments, strategies, and innovation services. Furthermore, it helps to draw attention to and find out how to target policy instruments and how proactive intervention could be the most worthwhile in the region.

6. REFERENCES

[1] Abraham S. (2005). "*Stretching strategic thinking*". Strategy & Leadership. Vol.33. No. 5. pp. 5-12

[2] Amit R. & Schoemaker P.J.H. (1993).*Strategic assets and organizational rent*. Strategic Management Journal. Vol.14. pp. 33-46

[3] Andrews K. (1987). The concept of corporate strategy. In De Wit B. and Meyer R. (2010). *Strategy Synthesis. Resolving strategy paradoxes to create competitive advantage.* 3rd edition. South-Western CEGAGE Learning.

[4] Anttila P. (2006). *Tutkiva toiminta ja ilmaisu, teos, tekeminen.* AKATIIMI Oy. (in Finnish)

[5] Bathelt H. (2003). *Geogrpahies of production: growth regimes in spatial perspective 1 – innovation, institutions and social systems.* Progress in Human Geography. Vol. 27. No. 6. pp. 763-778

[6] Becheikh N., Landry R. & Amara N.(2006). *Lessons from innovation empirical studies in the manufacturing sector: A systematic review of the literature from 1993-2003*. Technovation. Vol. 26. pp. 644-664

[7] Bonn I. (2001). *Developing strategic thinking as a core competency*. Management Decision. Vol. 39. No. 1. pp. 63-71

[8] Checkland P. (1981). *Systems Thinking, Systems Practice.* John Wiley & Sons, Chichester

[9] Checkland P. & Scholes J. (1990). *Soft Systems Methodology in Action*. WILEY

[10] Cooke P. (2008). *Regional innovation systems, clean technology & Jacobian cluster-platform policies.* Regional Science Policy & Practice. Vol. 1. No. 1. pp. 23-45

[11] Dosi G., Teece D. & Silverberg G. (eds.). (1998). *Technology, Organiation and Competitiveness; Perspectives on Industrial and Corporate Change*. Oxford University Press

[12] Field A.P. (2005). *Discovering statistics using SPSS*. 2nd edition. London Sage

[13] Hendry J., Johnson G. & Newton J. (eds.). (1993). *Strategic Thinking. Leadership and the Management of Change.* John Wiley & Sons.

[14] Kaiser H.F. (1974). *An index of factorial simplicity.* Psychometrika. Vol. 39. Pp. 31-36

[15] Kautonen M. (2006). *The Regional Innovation System Bottom-up: A Finnish Perspective. A Firm-level Study with Thoretical and Methodological Reflections.* Academic Dissertation. University of Tampere.

[16] Liedtka J. (1998). *Strategic thinking: can it be taught?* Long Range Planning. Vol. 31. No. 1. pp. 120-129

[17] Luhmann N. (2006). *Systems as difference.* Organization. Vol. 13. No. 1. pp. 37-57

[18] Nauwelaers C. & Wintjes R. (2000). SME policy and the Regional Dimension of Innovation: Towards a New Paradigm for Innovation Policy? *MERIT Research Memoranda 2000-023.*

[19] Nilsson M. & Moodysson J. (2011). *Policy coordination in systems of innovation: A structural-functional analysis of regional industry support in Sweden*. Paper no. 2011/09. Lund University.

[20] Nummenmaa L.(2009). *Käyttäytymistieteiden tilastolliset menetelmät.* Tammi. (in Finnish)

[21] OECD. (2010).*Measuring Innovation. A New Perspective*. OECD Innovation Strategy.

[22] OECD. (2011). *Regions and Innovation Policy. OECD Reviews of Regional Innovation.* OECD Innovation Strategy.

[23] Patton M.Q. (2002). *Qualitative research and evaluation methods* in: Suri H. (2011) Purposeful Sampling in Qualitative Research Synthesis. Qualitative Research Journal. Vol. 11. No. 2. pp. 63-75

[24] Porter M. & Stern S. (2001). *Innovation: location matters*. MIT Sloan Management Review. Summer *2001.* pp. 28-36

[25] Prahalad C.K. & Krishnan M.S.(2008). *The new age of innovation. Driving cocreated value through global networks.* McGrawHill.

[26] Ranta T. & Uitto A. (2009). *Yhteiseltä areenalta globaaleille markkinoille – Pohjois-Pohjanmaan, Kainuun ja Lapin innovaatioympäristöjen yhteisöllinen toimintamalli.* Teles katsaus 260/2009. (in Finnish)

[27] Senge P.M. (1990).*The Fifth Discipline*. Currency Doubleday

[28] Shaw M.L.G. & Gaines B.R. (1996). *Requirements Acquisition.* IEE Software Engineering Journal. Vol. 11. No. 3. pp. 149-165
[29] Singer J.G. (2008). *Strategically thinking about the subject of strategy.* Business Strategy Series. Vol. 9. No. 4. pp. 211-212
[30] Stacey R.D. (ed.). (2003). *Strategic Management and Organizational Dynamics*. 3rd edition. FT Prentice Hall.
[31] Sternberg R. & Arndt O. (2001). *The firm or the region: what determines the innovation behavior of European firms?* Economic Geography. Oct. 2001. Vol. 77. No. 4. pp. 364-382
[32] Vos J-P. (2005). *Developing strategic self-descriptions of SMEs.* Technovation. Vol. 25. pp. 989-999
[33] Vos J-P.(2002). *The Making of Strategic Realities. An Application of the Social Systems Theory of Niklas Luhmann*. Technische Universiteit Eindhoven.
[34] Walendowski J., Kroll H., Stahlecker T., Baier E., Wintjes R. & Hollanders H. (2011). *Regional Innovation Monitor. Innovation Patterns and Innovation Policy in European Regions – Trends, Challenges and Perspectives.* 2010 Annual Report. European Commission. Enterprise and Industry Directorate-General.
[35] Wintjes R. & Hollanders H. (2010). *The regional impact of technological change in 2020. Synthesis report*. Directorate-General Regional Policy. ETEPS AISBL.
[36] Zahn E. (1999). *Strategizing Needs Systems Thinking.* Proceedings of the 17th Int. conference of the System Dynamics Society. Wellington, New Zealand

Annex 1

Table I Innovation environment. Communalities.

Communalities		
	Initial	Extraction
VAR01	1,000	,758
VAR02	1,000	,894
VAR03	1,000	,901
VAR04	1,000	,764
VAR05	1,000	,751
VAR06	1,000	,869
VAR07	1,000	,805
VAR08	1,000	,784
VAR09	1,000	,842
VAR10	1,000	,826
VAR11	1,000	,748
VAR12	1,000	,875
VAR13	1,000	,883
VAR14	1,000	,748
VAR15	1,000	,632
VAR16	1,000	,828
VAR17	1,000	,761
VAR18	1,000	,913
VAR19	1,000	,645
VAR20	1,000	,762

Table VII Innovation capability. Communalities.

Communalities	Initial	Extraction
VAR01	1.000	.769
VAR02	1.000	.806
VAR03	1.000	.761
VAR04	1.000	.789
VAR05	1.000	.684
VAR06	1.000	.822
VAR07	1.000	.788
VAR08	1.000	.814
VAR09	1.000	.800
VAR10	1.000	.839
VAR11	1.000	.694
VAR12	1.000	.721
VAR13	1.000	.726
VAR14	1.000	.730
VAR15	1.000	.825
VAR16	1.000	.841
VAR17	1.000	.692
VAR18	1.000	.806
VAR19	1.000	.804

Table II Innovation environment. Total Variance Explained.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,708	13,542	13,542	2,708	13,542	13,542	2,593	12,964	12,964
2	2,637	13,187	26,728	2,637	13,187	26,728	2,256	11,281	24,245
3	2,390	11,948	38,676	2,390	11,948	38,676	1,755	8,774	33,019
4	1,871	9,354	48,030	1,871	9,354	48,030	1,736	8,680	41,698
5	1,695	8,474	56,504	1,695	8,474	56,504	1,603	8,016	49,714
6	1,304	6,519	63,024	1,304	6,519	63,024	1,584	7,921	57,636
7	1,210	6,048	69,072	1,210	6,048	69,072	1,554	7,771	65,407
8	1,165	5,825	74,897	1,165	5,825	74,897	1,495	7,477	72,884
9	1,009	5,047	79,944	1,009	5,047	79,944	1,412	7,060	79,944
10	,883	4,417	84,361						
11	,576	2,882	87,243						
12	,545	2,726	89,970						
13	,436	2,182	92,152						
14	,412	2,060	94,212						
15	,278	1,392	95,605						
16	,257	1,283	96,888						
17	,227	1,136	98,024						
18	,162	,810	98,834						
19	,141	,706	99,541						
20	,092	,459	100,000						

Note: Extraction Method: Principal Component Analysis.

Table III Innovation environment. Rotated Component Matrix.

	Component									
	E1	**E2**	**E3**	**E4**	**E5**	**E6**	**E7**	**E8**	**E9**	**Variable**
VAR14	,809									barrier to innovation – own financing capability
VAR11	,737									goal to innovation – growth of markets
VAR09	,733				,445					importance of innovation types – marketing
VAR03		,739					-,438			own innovation activities – customer needs
VAR01		,729								own innovation activities – own r&d
VAR04		,718								own innovation activities – collecting ideas from
VAR05		,675								own innovation activities – market research
VAR13			,859							goal of innovation – improvement of production
VAR12			,843							goal of innovation – improvement of quality
VAR18				,884						used idea sources – customers
VAR06				,793						own innovation activities – collecting ideas from
VAR08					,841					importance of innovation types – service
VAR20						-,801				need of support for innovation – commercial
VAR16						,645				barrier to innovation – lack of time
VAR02							,904			own innovation activities – outsourced r&d
VAR17							,402	,597		barrier to innovation – lack of knowledge on
VAR15								,520		barriewr to innovation – lack of financial support
VAR07									,819	importance of innovation types – product
VAR10	,518								,678	goal to innovation – getting to new markets

Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Table IV Value delivery.Communalities.

Communalities

	Initial	Extraction
VAR01	1.000	.560
VAR02	1.000	.673
VAR03	1.000	.712
VAR04	1.000	.792
VAR05	1.000	.672
VAR06	1.000	.715
VAR07	1.000	.619
VAR08	1.000	.718
VAR09	1.000	.586
VAR10	1.000	.563

Table V Value delivery. Total Variance Explained.

	Initial Eigenvalues			Extraction Sums of Squared			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.23	22.333	22.333	2.23	22.333	22.333	1.92	19.274	19.274
2	1.88	18.874	41.207	1.88	18.874	41.207	1.83	18.330	37.603
3	1.27	12.722	53.930	1.27	12.722	53.930	1.50	15.066	52.669
4	1.21	12.183	66.113	1.21	12.183	66.113	1.34	13.444	66.113
5	.912	9.118	75.231						
6	.809	8.091	83.322						
7	.565	5.647	88.969						
8	.415	4.155	93.123						
9	.361	3.606	96.729						
10	.327	3.271	100.000						

Table VI Value delivery**.** Rotated Component Matrix.

	Component				
	V1	**V2**	**V3**	**V4**	**Variable**
VAR04	.866				Radical or moderate innovations
VAR03	.795				Product innovations
VAR05	.538			.524	Time horizon 2
VAR06		.835			Idea generation needs
VAR09		.711			Needs for commercial innovation services
VAR01		.687			Needs of value identification phase
VAR08			.825		Needs for technical services
VAR10			.735		Services of UAS
VAR02				.785	Micro size firms
VAR07				.576	Needs for partners

Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Table VIII Innovation capability. Total Variance Explained.

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.641	24.425	24.425	4.641	24.425	24.425	2.730	14.369	14.369
2	2.727	14.352	38.777	2.727	14.352	38.777	2.579	13.571	27.941
3	2.271	11.953	50.729	2.271	11.953	50.729	2.093	11.015	38.955
4	1.555	8.182	58.911	1.555	8.182	58.911	1.927	10.142	49.097
5	1.227	6.457	65.368	1.227	6.457	65.368	1.866	9.823	58.920
6	1.191	6.266	71.634	1.191	6.266	71.634	1.758	9.251	68.171
7	1.099	5.786	77.420	1.099	5.786	77.420	1.757	9.249	77.420
8	.789	4.153	81.573						
9	.661	3.481	85.054						
10	.557	2.934	87.987						
11	.464	2.444	90.431						
12	.397	2.088	92.519						
13	.385	2.024	94.543						
14	.320	1.686	96.229						
15	.241	1.266	97.495						
16	.168	.886	98.381						
17	.146	.766	99.147						
18	.095	.498	99.645						
19	.067	.355	100.000						

Table IX Innovation capability. Rotated Component Matrix.

	Component							
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**Variable**
VAR02	.864							Cap. To create partnership
VAR12	.786							Cap. To utilize innovations developed elsewhere
VAR03	.659							Cap. To utilize networks
VAR05		.751						Cap. To move to new markets
VAR04		.716						Cap. To find new markets
VAR09	.457	.659						Cap. To create new successful business
VAR07		.652	.502					Cap. To identify new business opportunities
VAR17		.492		.487				Cap. To evaluate innovation risks
VAR08			.807					Cap. To catch new business opportunities
VAR01			.695					Own networking activity
VAR11			.496		.438			Cap. To improve current products and service
VAR18				.844				Will to take innovation risks
VAR19				.827				Cap. To take innovation risks
VAR13					.789			Cap. To find the latest knowledge in the field
VAR14					.709			Cap. To utilize the latest knowledge
VAR15						.873		Cap. To produce new ideas for the business
VAR10						.805		Cap. To develop new different innovations
VAR06							.843	Cap. To increase sales in current markets
VAR16							.803	Cap. To change business operations quickly

Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Razvoj strateških inovacija zanovan na istraživanju sistema u ruralnom regionu

Minna Sarkkinen, Tuomo Kässi

Primljeno (06. februar 2013.); Recenzirano (20. maj 2013.); Prihvaćeno (27. maj 2013.)

Rezime:

Strateško razmišljanje je neophodno kako bi se objasnile različite dimenzije strateškog inovacionog menadžmenta. Ovo istraživanje definiše (gradi) i analizira tri pogleda na strateški inovacioni menadžment – inovaciono okruženje, isporuka vrednosti i inovacioni kapacitet, u kontekstu regionalnog inovacionog sistema. Cilj je da se prouči kako različite dimenzije opisuju inovacionu istuaciju i potrebe razvoja u kompanijama i na regionalnom nivou. Podaci za studiju su prikupljeni tokom 2011. godine u udaljenom ruralnom regionu u Finskoj. Logika svrsishodnog uzorkovanja je korišćena u selekciji 50 kompanija. Metodologija soft sistema je primenjena kao sistemski pristup istraživanja i eksploratorna faktorska analiza je korišćena kao metoda za analizu tri dimenzije. Na osnovu rezultata istraživanja je identifikovano nekoliko faktora koji formiraju tri dimenzije, koji mogu imati stukturnu vezu jedan sa drugim. Izdvojeni faktori su važnost mogućnosti umrežavanja i ciljevi inovacija povezani sa marketingom.

Ključne reči: *strateški inovacioni menadžment, sistem regionalnih inovacija, isporuka vrednosti, sposobnost inovacija, inovaciono okruženje, metodologija soft sistema*