Intangible aspects of innovation capability in SMEs: Impacts of size and industry

Saunila Minna, Ukko Juhani

DOI: 10.1016/j.jengtecman.2014.02.002

Saunila, M., & Ukko, J. (2014). Intangible aspects of innovation capability in SMEs: Impacts of size and industry. Journal of Engineering and Technology Management, 33, 32-46.

INTANGIBLE ASPECTS OF INNOVATION CAPABILITY IN SMES: IMPACTS OF SIZE AND INDUSTRY

Abstract

In the current literature, developing innovation capability in an organization is increasingly important. The approach of this study is quantitative. The data for the study were gathered using a web-based questionnaire targeting Finnish SMEs employing 11-249 persons and with less than 50 Meuro in revenue. A sample of 2,400 SMEs was randomly selected. The response rate was 7.68 percent. This paper contributes to current understanding by presenting a construct for categorizing the intangible aspects of organizational innovation capability. The study also reveals that a firm's size or industry does not have a remarkable effect on the firm's innovation capability.

Keywords: innovation capability, SME, size, industry

1 Introduction

The successful operation of firms in almost all industries is becoming highly dependent on the firms' abilities to produce innovations. Innovation is a process of turning opportunities into new ideas and turning these ideas into widely used practices (Tidd, Bessant and Pavitt, 2005). Innovation is more than just a great idea; it is the opportunity to solve a problem that matters. The key is executing an idea in useful practice. Scholars have suggested that innovation capability is a multi-faceted construct. The categories used for innovation capability often adopt a certain type of innovation, such as product innovation, instead of the overall innovation capability (Ibrahim et al., 2009). In addition, innovation capability has been divided into radical and incremental innovation capabilities (Sen and Egelhoff, 2000). Moreover, the current literature has concentrated on evaluating a firm's innovation capability by defining the types of capabilities that form the overall innovation capability. For example, product innovation capability, process innovation capability, market innovation capability, strategic innovation capability, organizational capability, manufacturing capability, networking capability, entrepreneurial capability, and R&D capability have been studied (see Christensen, 1995; Guan and Ma, 2003; Wang and Ahmed, 2004; Forsman, 2009). However, no dominant theoretical perspective integrates the individual sections of innovation research (Drazin and Schoonhoven, 1996). Therefore, innovation capability needs to be defined through an empirical study using existing innovation research.

The concept of innovation capability presented in this paper is intangible because innovation capability refers to the potential to create innovations. Due to the special features of SMEs, the

potential for innovation is observed as more important than the commercial end. The scarcity of resources, including human resources (both management and personnel), financial capital, time, and security, has been considered one of the features of SMEs (e.g., Singh et al., 2008; Ates et al., 2013). Although size represents a weakness in terms of available resources, it favors a flat organizational structure with a lack of bureaucracy. This size dependence allows for flexibility, adaptability and speed in responding to the changing environment. (Garengo et al., 2005) For this reason, SMEs usually have a high potential for innovation, which may result in types of innovations other than just commercial products. Innovation capability, similar to intangibles in general, is hard to specify directly, but it can be specified by defining closely related aspects. These aspects of innovation capability are also innovation activity inputs. According to Davila, Epstein and Shelton (2006), the inputs are the resources dedicated to creating innovations. Theses inputs may be tangible, such as people, money, time, equipment, etc., or intangible, such as motivation, knowledge and firm culture. Many studies have presented intangible aspects related to innovation capability (Lawson and Samson, 2001; Martensen et al., 2007; Skarzynski and Gibson, 2008; Tura, Harmaakorpi and Pekkola, 2008; Paalanen, Kujansivu and Parjanen, 2009) but often from a theoretical perspective. The results have seldom been based on empirical studies, as is the case in this study. In addition, this study caters to various aspects of innovation capability, departing from the majority of existing empirical studies that focus only on one or two intangible aspects of innovation capability (e.g., culture, structures).

The objective of this study is to define the intangible aspect of a firm's innovation capability using a questionnaire targeting Finnish SMEs. The paper contributes to current understanding by presenting a construct for categorizing the intangible aspects of a firm's innovation capability in practice. In this respect, the nature of the study is explorative. Another purpose of the paper is to clarify whether innovation capability differs with the size and industry of the firm. The results contribute to the existing discussion on innovation capability by diminishing the gap between theory and practice and by building requisites for further research.

2 Literature review

2.1 Definition of innovation capability

According to Lawson and Samson (2001), innovation capability is a theoretical framework aimed at describing the actions that can be taken to improve the success of innovation activities. Innovation capability consists mainly of the firm’s intangibles. Intangibles are the non-physical characteristics of a firm, which will produce value in the future (Kannan and Aulbur, 2004). Intangibles, which are referred to as potential in this paper, are not assets as such. Exploiting intangibles generates results (Bontis, 2001; Marr, 2007). Innovation capability is composed of the main processes within the firm and cannot be separated from the main practices because innovation capability is the potential to carry out the practices. Neely et al. (2001) also suggest

that a firm's innovation capability is the potential to generate innovative outputs. Similarly, Lawson and Samson (2001, p. 384) define innovation capability as "the ability to continuously transform knowledge and ideas into new products, processes and systems for the benefit of the firm and its stakeholders." Sáenz, Aramburu and Rivera (2009) consider innovation a dynamic capability with multiple aspects (i.e., a capability that allows the firm to integrate, build, and reconfigure internal and external competences to address rapidly changing environments (Teece, Pisano and Shuen, 1997)). Shoham et al. (2012) view organizational innovation as a firm's ability to be creative, ready to take risks, oriented toward the future, open to change, and proactive.

2.2 Aspects of innovation capability

Similarly, in this paper, innovation capability is defined as the drivers of innovation; i.e., the aspects that influence a firm's ability to manage innovation. According to the literature, these aspects include support culture (Lawson and Samson, 2001; Tidd et al., 2005; Wan, Ong and Lee, 2005; Martensen et al., 2007; Skarzynski and Gibson, 2008; Smith et al., 2008; Paalanen et al., 2009), employees' skills and innovativeness (Martensen et al., 2007; Skarzynski and Gibson, 2008; Tura et al., 2008; Smith et al., 2008; Paalanen et al., 2009), employees' welfare (Laforet, 2011), leadership practices (Bessant, 2003; Tidd et al., 2005; Martensen et al., 2007; Skarzynski and Gibson, 2008; Smith et al., 2008; Paalanen et al., 2009), processes and tools for managing ideas (Lawson and Samson, 2001; Tidd et al., 2005; Skarzynski and Gibson, 2008; Smith et al., 2008), development of individual knowledge (Bessant, 2003; Tidd et al., 2005), external sources for information (Romijn and Albaladejo, 2002; Tidd et al., 2005; Paalanen et al., 2009; Laforet, 2011), and links to strategic goals (Bessant, 2003; Martensen et al., 2007; Smith et al., 2008).

Support culture

A favorable culture that supports innovation is the key aspect of a firm's innovation capability in many theoretical studies (e.g., Lawson and Samson, 2001; Bessant, 2003; Wan et al., 2005; Skarzynski and Gibson, 2008). Bessant (2003) discusses high-involvement innovation, and the concept essentially comes down to creating a culture in which innovation is a way of life. Innovation capability requires a collaborative, open culture and incentives that reward challenging current actions (Skarzynski and Gibson, 2008). In a similar type of study, Wan et al. (2005) suggest that the important issues for innovation are the belief that innovation is important, a willingness to take risks, and a willingness to exchange ideas. Firms need to be tolerant of the mistakes that will occur and allow for recovery and learning from failures (Wan et al., 2005; Lawson and Samson, 2001). In addition, mutual trust and respect create an atmosphere that encourages individuals to try new ideas without fear of failure and its consequences (Lampikoski and Emden, 1999; Wan et al., 2005).

Employees' skills and innovativeness

A relationship between culture and creativity has been acknowledged in the literature (e.g., Amabile, 1997). People who are creative and are intrinsically motivated (as well as skilled) to do work will aid in creating a work environment that supports innovation. Creative thinking includes the following: The individual has new perspectives on problems, is willing to take risks, and has tolerance for ambiguity (Amabile, 1997). According to Kleysen and Street (2001), individual innovative behavior requires a good correlation between five dimensions: opportunity exploration, generativity, formative investigation, championing and application. According to Calantone, Cavusgil and Zhao (2002), to foster effective innovation, established norms, practices, and beliefs may have to be challenged. Thus, as business realities change, employees' behavior and actions need to adjust accordingly (Dobni, 2008).

Employees' welfare

An employee's motivation is also connected to his or her well-being and experience as a member of the work community (Viitala, 2005). According to McMurray et al. (2010), leaders who demonstrate empowering behaviors through transformational leadership enhance employees' well-being. According to Dobni (2008), a favorable culture requires employees be treated equally.

Leadership practices

Martensen et al. (2007) suggest that when firms aim for innovation excellence, innovativeness and the leaders' ability to guide and direct employees should be improved first. Today, leadership is observed as a skill for directing employees' energy in the right direction instead of giving orders and instructions (Lampikoski and Emden, 1999). Participative leadership boosts employees' trust in, commitment to, and appreciation of managers. Employees are also more motivated to do their tasks (Yukl, 1998). Skarzynski and Gibson (2008) stress that the leaders and the firm should share a common vision of innovation. The ability to lead, direct, and support creating and sustaining innovation behaviors is important for a firm (Bessant, 2003). Therefore, managers should invest time in increasing the personnel's opportunities to participate in development activities (Lampikoski and Emden, 1999), as well as strike a balance that allows employees to act on good ideas (Dobni, 2008).

Processes and tools for managing ideas

Innovation also requires support tools to enable an idea-generating pipeline (Skarzynski and Gibson, 2008). Lawson and Samson (2001) identify that proper firm structures and systems are likely to have an effect on innovation capability. Bessant (2003) emphasizes the importance of the ability to create consistency between innovation values and behavior and the firm context (structures, procedures, etc.), as well as the ability to move innovative activity across firm boundaries. According to Subramanian and Nilakanta (1996), decentralized and informal structures facilitate innovations. The authors also propose that the flexibility and openness of the structures help encourage new ideas. Reward systems are powerful motivators and foster creative behavior (Lawson and Samson, 2001).

Development of individual knowledge

According to Tura et al. (2008), expertise and knowledge are needed to build innovation. Romijn and Albaladejo (2002) have defined the internal and external factors that affect a firm's innovation capability. The internal factors include the knowledge and skills brought into the firm by the entrepreneurs and workforce, which they have obtained through experience. Employees' skills are important for building innovation capabilities across the firm (Skarzynski and Gibson, 2008). In addition, continuous learning orientation is central for innovation (Calantone et al., 2002). A firm committed to learning seeks a full understanding of the environment, including customers, competitors, and emerging technology. Tidd et al. (2005) state that an innovative firm includes key individuals and continues and stretches individual development. Yang (2012) concludes that firms have to be committed to learning to create a facilitating culture to foster and sustain the firms' innovation capability. Employees who are interested in developing expertise in innovation could be selected, trained, developed, and promoted (Kelley et al., 2011).

External sources of information

In addition to the focus on the internal aspects of innovation capability, external aspects are also acknowledged in the current literature. Absorptive capacity was originally constructed by Cohen and Levinthal (1990) and further developed by Zahra and George (2002). Absorptive capacity emphasizes where firms create and exploit new knowledge by transforming acquired knowledge (Zahra and George, 2002). According to Swink (2006), a firm's ability to collaborate externally is key to the firm's innovative success. The strength of inter-firm relationships influences the extent of tacit knowledge transfer, and the tacit knowledge obtained from partner firms affects a firm's innovation capability (Cavusgil, Calantone and Zhao, 2003). Interaction with suppliers, customers, industry associations, competitors, and others can provide missing external inputs that the firm itself cannot provide (Lawson and Samson, 2001; Romijn and Albaladejo, 2002).

2.3 Summary of the literature review

The previous categorizations of innovation capability are usually very general, and therefore, the intangible aspects of innovation capability need to be specified through an empirical study. Based on this review of the literature, items for measuring the intangible aspects of innovation capability have been developed. The items and their relevance for developing innovation capability are presented later in Table 1.

3 Hypothesis development

3.1 Firm size and innovation capability

Many researchers have studied how innovation varies according to firm size. According to Bertschek and Entorf (1996), the relationship between innovation and firm size is not linear because small and large firms are more innovative than medium-sized firms. Researchers have studied the relationship between firm size and process innovations (e.g., Wolff and Pett, 2006; Laforet, 2008; Plehn-Dujowich, 2009; Damanpour, 2010), product innovations (e.g., Wolff and Pett, 2006; Plehn-Dujowich, 2009; Damanpour, 2010), manufacturing approaches (e.g., Zahra and George, 2000), and R&D activities (e.g., Cohen and Klepper, 1996; Galende and Suárez, 1999; Forsman and Rantanen, 2011). However, the current literature lacks research on the relationship between the intangible aspects of innovation capability and firm size. Small firms are typically characterized as resource-constrained (Wolff and Pett, 2006), and therefore, they may also have a lower level of potential to create innovations.

H1: Medium sized firms have higher levels of the aspects of innovation capability than small firms

3.2 Firm industry and innovation capability

The relationship between industry and innovation capability has been discussed in the literature (Pavitt, 1984; Castaldi, 2009). For example, Castaldi (2009) concludes that some industries simply display larger opportunities than others in terms of technical progress. However, industrial firms may also have different characteristics. For example, Heidenreich (2009) studied low- and medium-technology industries that depend on externally provided machines, equipment, and software. The firms in these industries have more similar features than service sector firms. In the service sector, the focus is often on a knowledge-based understanding of technology rather than how to generate it (Berga and Einspruch, 2008). Forsman (2011) did not find any tremendous differences in innovation capability between industries. However, the study concentrated on micro companies. Generally, manufacturing and service industries are different regarding innovation (e.g., Castaldi, 2009). Therefore, the capability to produce innovations likely also varies between industries. Based on previous research, it is hypothesized that service firms have greater levels of innovation capability than industrial firms.

H2: Service firms have higher levels of the aspects of innovation capability than industrial firms

4 Methodology

4.1 Questionnaire design

The approach of this study is quantitative. The first step was to construct a questionnaire for the themes related to innovation capability. The items for the questionnaire were

operationalized based on a literature review. Some efforts were made to maximize the validity and reliability of the questionnaire. When available and appropriate, existing measurements that had been empirically tested in previous studies were used. New items were built based on theories. The items were reviewed and revised with a group of researchers familiar with innovation capability. The researchers were asked to critically analyze the concept each item measured in relation to innovation capability. This step resulted in minor changes in the presentation of the questionnaire. At the end of this phase, 30 items remained in the final version. The items, their original references, and their relevance for developing innovation capability are shown in Table 1.

Table 1. Items and references

Item	**Item modified from**	**Relevance for innovation capability**
1 My work community encourages gaining knowledge through external contacts	Martensen et al., 2007 Dobni, 2008	Firm's attitude toward obtaining knowledge outside the firm affects innovation capability
2 We developed our methods of action by comparing our operations to other organizations	Guan and Ma, 2003	Firm's ability to collaborate externally is key to the firm's innovation capability
3 We develop our actions with our stakeholders (customers, etc.)	Dobni, 2008 Kallio, Kujansivu and Parjanen, 2012	Interaction with stakeholders can provide information required to develop innovation capability that the firm itself cannot provide
4 Co-operation works well in our organization	Kallio et al., 2012	Innovation capability benefits exchanging knowledge across firm boundaries
5 We have a clear way of processing and developing ideas	Martensen et al., 2007	Innovation requires support mechanisms to enable generating and processing ideas
6 Employees get feedback on their ideas	Otala, 2003	Innovation capability requires a collaborative and open culture for feedback
7 Our reward system encourages coming up with ideas	Tang, 1999	Reward systems are good motivators and foster innovative behavior
8 Our organization actively seeks new methods of action	Hurt, Joseph and Cook, 1977 Martensen et al., 2007	Established practices and beliefs may have to be challenged to develop innovations
9 Our organization has the courage to try new methods of action	Wang and Ahmed, 2004	Innovation capability benefits an atmosphere that encourages trying new ideas without fear of failure
10 When experimenting with new methods of action, mistakes are allowed	Dobni, 2008	A favorable culture for innovation capability is tolerant of mistakes
11 Employees have the courage to disagree	Wang and Ahmed, 2004	An effective innovation culture tolerates employees who think differently
12 Managers encourage initiatives	Wang and Ahmed, 2004 Kallio et al., 2012	Managers need to give employees enough freedom regarding their tasks to enhance the employees' well-being and innovation capability
13 Managers give positive feedback	Martensen et al., 2007	To foster innovation capability, managers need to direct employees' energy in the right direction instead of giving orders and instructions
14 Managers pass employees' ideas on to the upper levels of the organization	Dobni, 2008 Martensen et al., 2007	Managers need to show their support with regard to good ideas by passing ideas forward

15 Managers participate in generating and developing ideas	Tang, 1999	Participative leadership boosts employees' commitment to developing innovation capability
16 Employees are willing to participate in development	Tang, 1999 Kallio et al., 2012	Employees need to share the belief that innovation is important and be willing to exchange ideas
17 It is easy for employees to adopt new methods of action	Hurt et al., 1977	To continuously create new innovations, employees' behavior and actions need to adjust according to the changing business environment
18 The employees know how to be critical of current methods of action when needed	Dobni, 2008	Employees need to have new perspectives on problems to create innovations
19 All employees have a possibility for education	Samson and Terziovski, 1999	Innovation capability requires continuing and stretching individual development
20 We have instructions and responsible persons for work orientation	Otala, 2003	The need for continuous learning for innovation is fulfilled
21 Employees are encouraged to be multi-skilled	Otala, 2003	Employees' expertise and knowledge are needed to build a firm's innovation capability
22 Voluntary learning and development of expertise are supported in our organization	Otala, 2003	Employees who are interested in developing expertise in innovation are supported
23 There are practices for transferring tacit knowledge	Otala, 2003	A firm committed to learning for innovation seeks methods of transferring knowledge between employees
24 In our organization, learning is an investment, not an expense	Calantone et al., 2002	To develop innovation capability, firms have to be committed to learning to create a facilitating culture to foster and sustain the firms' innovation capability
25 Employees prosper in our organization	Samson and Terziovski, 1999	It is important for developing innovation capability that employees are motivated and feel they are members of the work community
26 Employees are treated equally	Dobni, 2008	A favorable culture for innovation requires that the employees are treated equally
27 Employees are appreciated for their work	Dobni, 2008	Employees are more motivated to develop innovations if their contribution is appreciated
28 The number of work tasks is suitable	Tang, 1999	Employees need to have enough time to develop innovation capability
29 The tasks' quality, demands, and responsibility are suitable	Otala, 2003	The work requirements need to be in line with the ambitions regarding innovation
30 There is an opportunity for flexible work and work hours in our organization	Otala, 2003	Flexibility and openness help to encourage developing innovations

As presented earlier, all of the items are not presented exactly the same as the original item. In the current research, the items were placed in organizational and not individual levels as some of the original items. As an example, item 26 was formulated "Employees are treated equally". This item was chosen as the final version, although its wording is not equal to the original item of Dobni (2008). Rather, it ensured that the content is the same between the selected item and the original item (e.g., through the revision procedure of the researchers as presented above).

4.2 Sample and description of the data

The data for the study was gathered from Finnish SMEs with a web-based questionnaire. SMEs with fewer than 10 employees were excluded from the sample. A sample of 2,400 SMEs, employing 11-249 persons and with less than 50 million euro (Meuro) in revenue, was randomly selected. The categories for revenue and employees were determined based on EU recommendation (2003/361). The manager and employee representatives received an invitation to participate in the study. Thus, 4,800 questionnaires were sent out. A total of 4,050 questionnaires reached the respondents because 750 e-mail addresses were invalid.

For each item, the respondents were asked to indicate their opinion on a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). A neutral response ("neither disagree nor agree") was adopted to reduce uninformed responses. The questionnaire was delivered in four waves. One week after the questionnaire was first mailed, reminder questionnaires were sent out. The remaining two reminders were sent a week after the previous reminder. This process resulted in 311 responses, which equals a response rate of 7.68 percent.

To check the non-response bias, an analysis of variance (ANOVA) test was performed. The respondents were divided into four groups: the first respondents, the first follow-ups, the second follow-ups, and the third follow-ups. The ANOVA results revealed that there was no significant difference (at the 5 percent significance level) between the four groups. Therefore, the responses reflect the entire sample well.

The respondents' background information is presented in Table 2. The division in responses depending on the revenue and number of employees agrees with the entirety of Finnish SMEs. As observed, the responses are quite equally divided into industrial and service enterprises. The majority of the responses were received from executives, and approximately 30 percent of the responses were from employees.

Also other selection biases were assessed to ensure the representativeness of the sample. To minimize voluntary response bias and under coverage bias, the sample was selected randomly. In this way, it ensured that different types of SMEs are adequately represented in the sample. In addition, it ensured that multiple responses did not come from a single respondent. Some procedural remedies were used to minimize the potential effects of the common method bias, as suggested by Podsakoff et al. (2003). Respondents were allowed to answer anonymously. In the cover letter, the respondents were encouraged to answer the questions as truthful as possible. In this way, the respondents are less likely to edit their responses to be more socially desirable. Another way of reducing common method biases is careful construction of the items themselves. This technique was used by paying attention to the wording and ease of comprehension. The items were also reviewed and revised by a group of researchers familiar with the topic. In addition to procedural techniques, statistical analyses were conducted.

Harman's single-factor test was used to statistically address the issue of common method bias. All of the variables used in the study were loaded into exploratory factor analysis, and the unrotated factor solution was analyzed. Either of the criteria of the technique (i.e., emergence of a single factor from the factor analysis or one general factor accounting for the majority of the covariance of the measures) was met. Thus, no common method variance exists. (Podsakoff et al., 2003)

Table 2. Background information of the respondents

		n	**%**
Revenue (Meuro)	2-5	141	45.3
	5-20	135	43.4
	20-50	35	11.3
No. of employees	10-49	224	72.0
	50-249	87	28.0
Industry	Industrial	145	46.6
	Service	159	51.1
	No response	7	2.3
Position	Executive	222	71.4
	White-collar worker	68	21.9
	Blue-collar worker	12	3.9
	No response	9	2.9

5 Findings

5.1 Categorization of innovation capability

To analyze the collected data, factor analysis was used to extract the underlying aspects of firm innovation capability. Using the Kaiser-Meyer-Olkin (KMO) test, the sample adequacy for all variables was analyzed. The overall KMO value was 0.878. This value is acceptable for this type of analysis (de Vaus, 2002). Then, principal component analysis with a varimax rotation was used to extract the relevant factors. One item was excluded because it loaded into one factor. According to Hair et al. (2010), factor loadings in the range of 0.30 to 0.40 are considered to meet the minimal level for interpretation of structure, and loadings 0.50 or greater are considered practically significant. Matsunaga (2010) states that on a conventional liberal-to-conservative continuum, setting the cutoff at .40, is the lowest acceptable threshold. In the current study the loadings greater than .40 are considered significant. As observed in Table 3, the items 27, 11 and 21 loaded onto two factors. According to Hair et al. (2010), the process of interpretation would be greatly simplified if each variable had only one significant variable, but most factor solutions do not result in a simple structure solution. In practice, the researcher may find that one or more variables have moderate-size loadings on several factors, all of which are significant, and the job of interpreting the factors is much more difficult (Hair et al., 2010). One widely utilized approach is to focus on the highest factor loading with the cutoff value. If an item's highest factor loading is greater than the a priori determined cutoff value, then

researchers retain that item in the pool (Matsunaga, 2010). Whichever approach the researchers decide to take, the ultimate objective should always be to obtain a factor structure with both empirical and conceptual support, as well as the fidelity and replicability (Hair et al., 2010; Matsunaga, 2010). In this study, the cross-loaded items were included with the factors, to which they had the highest loading, and the second highest factor loadings were dropped from the analysis. This procedure is an appropriate choice because there are several adequate to strong loaders (0.50 or better) on each factor, and all seven factors include three or more items (Costello and Osborne, 2005). This choice also results in a factor structure with conceptual support.

Based on the factor analysis procedure, seven factors (based on an eigenvalue greater than 1) were obtained (see Table 3). This solution explained 58.2 percent of the total variance. The seven factors extracted based on this solution are as follows:

1) Participatory leadership culture factor. The first factor is comprised of six items. This first factor includes a set of items directly or indirectly related to the leadership culture that supports innovation. The dimension reflects the overall atmosphere of a firm that supports innovation and a leadership culture that facilitates innovation. The factor explains 28.2 percent of the variance.
2) Ideation and organizing structures factor. The second factor is also comprised of six items. This factor includes a set of items directly related to the structures and systems that successful innovation requires (ideation structures and the ways in which the work is organized). The factor explains 6.78 percent of the variance.
3) Work climate and well-being factor. The third factor is comprised of five items. This factor includes items that represent employee well-being and the work climate for developing innovations. The factor explains 5.84 percent of the variance.
4) Know-how development factor. The fourth factor is comprised of three items. This factor concludes that employee expertise plays an important role in developing a firm's innovation capability. The factor explains 4.79 percent of the variance.
5) Regeneration factor. The fifth factor is also comprised of three items. This factor includes items that measure the firm's ability to learn from earlier experience and use that experience to create innovations and develop operations. The factor explains 4.35 percent of the variance.
6) External knowledge factor. The sixth factor is also comprised of three items. This factor clearly emphasizes the importance of exploiting external networks and knowledge for the firm's overall innovation capability. The factor explains 4.24 percent of the variance.
7) Individual activity factor. The seventh factor is also comprised of three items. This factor expresses that employees' individual innovation capability and activity is needed to form a firm's overall innovation capability. The factor explains 3.98 percent of the variance.

To test the reliability, a Cronbach's alpha test was performed. The alpha values of six factors, as shown in Table 3, are greater than 0.60, which is acceptable (De Vellis, 1991). In one factor (individual activity), the alpha value was less than 0.50, which indicates that the reliability of the factor can be questioned. Therefore, the results involving that factor should be handled circumspectly. The overall alpha value of the remaining 29 items is 0.903. The overall reliability of the construct is therefore supported.

Table 3. Factor analysis results (loadings over 0.4 presented)

	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**	**Factor 7**	**Comm.**
Cronbach's alpha	0.803	0.708	0.786	0.738	0.766	0.625	0.486	
12	0.698							0.584
13	0.702							0.631
14	0.705							0.648
15	0.756							0.677
23	0.404							0.350
27	0.469		0.442					0.565
5		0.688						0.673
6		0.517						0.532
7		0.556						0.573
20		0.497						0.461
28		0.514						0.436
29		0.574						0.469
4			0.491					0.550
11	0.416		0.476					0.537
21	0.429		0.496					0.512
25			0.768					0.682
26			0.731					0.687
19				0.737				0.634
22				0.711				0.642
24				0.655				0.618
8					0.676			0.661
9					0.742			0.671
10					0.740			0.672
1					0.442	0.592		0.563
2						0.797		0.712
3						0.726		0.590
16							0.697	0.562
17							0.654	0.526
18							0.550	0.473
Eigenvalue	8.196	1.966	1.694	1.389	1.261	1.229	1.154	
% of variance explained	28.262	6.778	5.843	4.790	4.349	4.239	3.981	
Cumulative	28.262	35.040	40.883	45.673	50.022	54.260	58.241	

Principal component analysis – Varimax rotation
KMO measure of sampling adequacy 0.878

5.2 Impacts of size and industry

Based on the results of the factor analysis, seven sum measures for a more efficient data analysis were formulated. The final factors and the means and standard deviations of the factors are presented in Table 4. Next, whether there were differences between the sizes of the firms and between industrial- or service-oriented firms regarding innovation capability was examined. The results of the correlation analyses are presented in Table 4, and the results of the stepwise regression analyses are presented in Table 5. A stepwise regression analysis was performed to analyze the influence of the firm size and industry on different aspects of innovation capability. Regression analyses were performed individually for each category of the intangible aspects of innovation capability presented in an earlier section.

Table 4. Means, standard deviations, and intercorrelations of the variables

	Mean	**Std. Dev.**	**Revenue**	**No of employees**	**Industry**
1 External knowledge	3.96	0.733	0.107	0.101	-0.023
2 Work climate and well-being	3.94	0.597	-0.060	-0.006	0.046
3 Ideation and organizing structures	3.45	0.628	-0.022	0.028	0.031
4 Regeneration	3.80	0.784	-0.027	0.055	0.033
5 Participatory leadership culture	3.65	0.613	-0.164**	-0.085	-0.038
6 Individual activity	3.59	0.612	-0.033	0.020	0.109
7 Know-how development	3.76	0.783	-0.071	-0.122*	0.212***

Sign. *** ≤ 0.001, ** 0.001 < p ≤ 0.01, * 0.01 < p ≤ 0.05

First, the differences were studied according to the amount of revenue. The revenue of the first group was 2-5 Meuro, that of the second group was 5-20 Meuro, and the revenue of the third group was 20-50 Meuro. As Table 5 indicates, only one significant difference was found in the factors. No significant differences were found when the firm size and industry and the following five intangible aspects of innovation capability were investigated: ideation and organizing structures, work climate and well-being, regeneration, external knowledge, and individual activity. The relationship between aspects of participatory leadership culture and revenue was significant (F = 5.255, Sig. 0.023). The adjusted R^2 was 0.014, meaning that 1.4 percent of the variance in the dependent variable (participatory leadership culture) can be explained by the model. Thus, hypothesis 1 is not supported with respect to participatory leadership culture. On the contrary, the smaller the firm, the more participatory the leadership culture. Hypothesis 1 is not supported by the other aspects of innovation capability either.

Next, the differences between companies with 10-49 employees and companies with 50-249 employees were studied. Contrary to previous studies (e.g., Çakar and Ertürk, 2010), the results suggest that the number of employees does not have a significant effect on innovation capability. No significant differences were found in the factors studied. Generally, the size of

the firm, including the amount of revenue and the number of employees, does not have a remarkable effect on the intangible aspects of innovation capability in SMEs.

Significant differences between industry- and service-oriented firms are presented next. In total, only one significant difference was found. When the relationship between innovation capability and industry was checked, the following was found: The regression model concerning know-how development (Table 5) was significant (F = 11.049, Sig. 0.001), with 3.4 percent of the variance explained. Therefore, the results reveal a positive relationship between industry and know-how development. Know-how development is arranged better in service-oriented firms. In contrast to industrial firms, service firms seem to have better possibilities for education, and learning is an investment rather than an expense. Thus, hypothesis 2 is supported with respect to know-how development. However, the orientation of the firm in industry or service did not have a comprehensive effect on the respondents' perceptions of the other intangible aspects of innovation capability. Therefore, hypothesis 2 is not supported regarding the other six aspects of innovation capability.

Table 5. Regression results of dependent variables

Dependent variables	**Participatory leadership culture**		**Know-how development**	
Independent variables	**Beta**	**t**	**Beta**	**t**
Revenue	-0.133	-2.292*	-0.008	-0.128
No. of employees	-0.006	-0.088	-0.087	-1.484
Industry	-0.079	-1.360	0.193	3.324***
F		5.255*		11.049***
R		0.133		0.193
R Square		0.018		0.037
Adjusted R Square		0.014		0.034

Sign. *** ≤ 0.001, ** 0.001 < p ≤ 0.01, * 0.01 < p ≤ 0.05

6 Discussion

The study categorizes the intangible aspects of firm innovation capability in SMEs. The majority of the existing empirical innovation capability studies focus on only one or two aspects of innovation capability. In general, the findings support the view that innovation capability is a multi-faceted construct that includes internal and external aspects. In this paper, a favorable leadership culture that supports innovation is a key aspect of firm innovation capability. The result is in line with earlier theoretical studies conducted by Lawson and Samson (2001), Bessant (2003), Skarzynski and Gibson (2008), and Smith et al. (2008). Martensen et al. (2007) suggest that when aiming for innovation excellence in a firm, innovativeness and the leaders' ability to guide and direct employees should be improved first. Another aspect of innovation capability is the employees' activity. People who are creative and are intrinsically motivated will be open to creating a work environment that supports innovation

(Amabile, 1997). The current study also suggests that individuals' activity and creativity is key when forming a firm's innovation capability.

Ideation and organizing structures are also needed to enhance innovation capability. Skarzynski and Gibson (2008) conclude that innovation requires support tools to enable an idea-generating pipeline. Therefore, a firm should make it easy for employees to be innovative by providing channels for ideas. In addition to proper structures, earlier studies note the knowledge and skills brought into the firm by the workforce are an important part of a firm's innovation capability (Romijn and Albaladejo, 2002). The current study also highlights the need to develop these skills to enhance innovation capability. This observation is in line with Tidd et al.'s (2005) study, which suggests that a firm capable of creating innovations includes continuing and stretching individual development. According to Salojärvi (2006), expertise and work well-being enable innovations. In the current study, work well-being is also an important aspect of a firm's ability to produce innovations.

External knowledge is also an important source of innovations. Lawson and Samson (2001) and Romijn and Albaladejo (2002) suggest that interactions with external sources can provide information the firm does not have. Swink (2006) states that a firm's ability to collaborate externally is a key to the firm's innovative success. According to this study, internal and external aspects are important when enhancing a firm's innovation capability.

The results emphasize not only the multidimensional nature of a firm's innovation capability but also the fact that there are no remarkable differences between firms of different sizes and industries with respect to innovation capability. The results indicate that there are no differences in the ability to produce innovations, although there might be differences in the innovativeness of firms of different sizes and in different industries. Based on the previous studies that found the firm size to be influential when developing innovations (e.g., Wolff and Pett, 2006; Plehn-Dujowich, 2009) and the results of the current study, there must be factors between innovativeness and innovation capability that influence whether a firm succeeds in producing innovations. Therefore, contrary to the previous studies that claim small firms are more resource-constrained (e.g., Wolff and Pett, 2006), it seems they do not necessarily have less innovation capability.

7 Conclusions

The purpose of this study was to examine whether a firm's size or the industry have a significant impact on intangible aspects of innovation capability in SMEs. As the main contribution, the results indicate that the size of the company does not explain the level of innovation capability. This result is important because previous studies found that small firms were more resource-constrained. However, this characteristic is not the case in innovation capability, and the differences between the intangible aspects of innovation capability in SMEs

must be studied and explained by other predictors. As an exception, the participatory leadership culture, which refers to the leaders' ability to guide and direct employees to be more innovative, was significantly higher in smaller companies. Thus, small firms are more innovative than medium-sized firms in terms of the leadership aspect of innovation capability that guides innovation.

In the other hypothesis, significant differences in intangible aspects of innovation capability for industrial- and service-oriented firms were studied. No major differences were found, apart from the differences in know-how development. This study contributes to the literature by showing that predictors other than industry must turn capability into successful innovations. The result is important because prior studies agree that manufacturing and service industries are different with respect to innovation. The greater ability of service-oriented firms in know-how development supports earlier findings, which suggest that the service sector focuses more on knowledge-based understanding of technology than on how to generate it.

Furthermore, the study aimed to empirically define the intangible aspects of firm innovation capability by conducting a questionnaire among SMEs. A categorization of the aspects was presented as the study result. The innovation capability categorization presented in this paper caters to various intangible aspects of innovation capability, departing from the majority of existing innovation capability studies that focus on only one or two intangible aspects of innovation. The study thus develops the fragmented theory of innovation capability by presenting a more holistic approach to innovation capability. In addition, this study contributes to current understanding by diminishing the gap between theory and practice; the majority of studies tend to capture these aspects of innovation capability as a whole and are theoretical. According to the statistical analysis, seven types of intangible aspects of firm innovation capability were discovered: participatory leadership culture, ideation and organizing structures, work climate and well-being, know-how development, regeneration, external knowledge, and individual activity.

The experiences of conducting the questionnaire in SMEs showed that it provided a proper picture of the multidimensional nature of firm innovation capability. As the sample covered more than 25 percent of Finnish SMEs with more than 10 employees and revenue of 2-50 Meuro, the results are inclusive. Innovation capability is a broad concept and should cover the entire range of different aspects. The categorization presented in this paper provides a good starting point for defining the intangible aspects of a firm's innovation capability. Using the results of this study, practitioners can improve their innovation capability to take better account of various aspects.

The presented categorization can also assist future research by providing guidelines for how innovation capability can be understood in practical settings. Because firm size and industry do not seem to comprehensively explain the differences in the intangible aspects of innovation

capability in SMEs, when pursuing better innovativeness in the future, it is beneficial to study the predictors that affect a firm's exploitation of the innovation capability. It is also important to study how the participatory leadership that guides employees for innovativeness is managed differently in small companies compared to medium-sized companies as well as the reasons behind the different types of know-how development in service-oriented firms compared to industrial firms. These issues can be tackled, for example, with in-depth case studies to achieve a deeper understanding of the mechanisms involved.

References

Amabile, T.M., 1997. Motivating creativity in organizations: On doing what you love and loving what you do. California management review, 40 (1): 39–58.

Ates, A., Bititci, U., 2011. Change process: a key enabler for building resilient SMEs. International Journal of Production Research, 49 (18): 5601–18.

Berga, D., Einspruch, N.G., 2008. Research note: Intellectual property in the services sector: Innovation and technology management implications. Technovation, 29 (5): 387–93.

Bertschek, I., Entorf, H., 1996. On nonparametric estimation of the Schumpeterian link between innovation and firm size: evidence from Belgium, France and Germany. Empirical Economics, 21 (3): 401–26.

Bessant, J., 2003. High-Involvement Innovation: Building and Sustaining Competitive Advantage Trough Continuous Change. John Wiley & Sons, Chichester.

Bontis, N., 2001. Assessing knowledge assets: a review of the models used to measure intellectual capital. International Journal of Management Reviews, 3 (1): 41–60.

Calantone, R.J., Cavusgil S.T., Zhao, Y., 2002. Learning orientation, firm innovation capability, and firm performance. Industrial Marketing Management, 31 (6): 515–24.

Castaldi, C., 2009. The relative weight of manufacturing and services in Europe: an innovation perspective. Technological Forecasting and Social Change, 76 (6): 709–22.

Cavusgil, S.T., Calantone, R.J., Zhao, Y., 2003. Tacit knowledge transfer and firm innovation capability. Journal of Business & Industrial Marketing, 18 (1): 6–21.

Christensen, J.F., 1995. Asset profiles for technological innovation. Research Policy, 24 (5): 727–45.

Cohen, W.M., Klepper, S., 1996. Firm size and the nature of innovation within industries: the case of process and product R&D. Review of Economics and Statistics, 78 (2): 232–43.

Cohen, W.M., Levinthal, D.A., 1990. Absorptive Capacity: A New Perspective on Learning and Innovation. Administrative Science Quarterly, 35 (1): 128–52.

Costello, A.B., Osborne, J.W., 2005. Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most from Your Analysis. Practical Assessment, Research & Evaluation, 10 (7): 1–9.

Damanpour, F., 2010. An Integration of Research Findings of Effects of Firm Size and Market Competition on Product and Process Innovations. British Journal of Management, 21 (4): 996–1010.

Davila, T., Epstein, M.J., Shelton, R., 2006. Making Innovation Work: How to Manage It, Measure It, and Profit from It. Upper Saddle River, New Jersey.

de Vaus, D.A. (2002) Surveys in Social Research. Allen & Unwin, Australia.

De Vellis, R.F. (1991) Scale Development: Theory and Applications. Sage, Newbury Park.

Dobni, C.B., 2008. Measuring innovation culture in organizations: The development of a generalized innovation culture construct using exploratory factor analysis. European Journal of Innovation Management, 11 (4): 539–59.

Drazin, R., Schoonhoven, C. B., 1996. Community, population, and organizational effects on innovation: a multilevel perspective. Academy of Management Journal, 39 (5): 1065–83.

EU recommendation (2003/361) of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises. Official Journal of European Union. [Read 1.1.2014: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:124:0036:0041:en:PDF]

Forsman, H., 2011. Innovation capacity and innovation development in small enterprises. A comparison between the manufacturing and service sectors. Research Policy, 40 (5): 739–50.

Forsman, H., 2009. Improving innovation capabilities of small enterprises: cluster strategy as a tool. International Journal of Innovation Management, 13 (2): 221–43.

Forsman, H., Rantanen, H., 2011. Small manufacturing and service enterprises as innovators: a comparison by size. European Journal of Innovation Management, 14 (1): 27–50.

Galende, J., Suárez, I., 1999. A resource-based analysis of the factors determining a firm's R&D activities. Research Policy, 28 (8): 891–905.

Garengo, P., Biazzo, S., Bititci, U.S., 2005. Performance measurement systems in SMEs: a review for a research agenda. International Journal of Management Reviews, 7 (1): 25–47.

Guan, J., Ma, N., 2003. Innovative capability and export performance of Chinese firms. Technovation, 23: 737–47.

Hair, J.F., Jr., Black, W.C., Babin, B.J, Anderson, R.E., 2010. Multivariate Data Analysis: A Global Perspective, 7th ed., Prentice-Hall, Upper Saddle River, NJ.

Heidenreich, M., 2009. Innovation patterns and location of European low- and medium-technology industries. Research Policy, 38 (3): 483–94.

Hurt, T.H., Joseph, K., Cook, C.D., 1977. Scales for the measurement of innovativeness. Human Communication Research, 4 (1): 58–65.

Ibrahim, A.R., Zolait, A.H.S., Subramanian, S., Ashtiani, A.V., 2009. Organizational Innovative Capabilities: An Empirical Study of Malaysian Firms. Journal of Innovation and Business Best Practices, 1 (2): 9–18.

Kallio, A., Kujansivu, P., Parjanen, S., 2012. Locating the weak points of innovation capability before launching development project. Interdisciplinary Journal of Information, Knowledge, and Management, 7 (1): 21–38.

Kannan, G., Aulbur, W. G., 2004. Intellectual capital. Measurement effectiveness. Journal of Intellectual Capital, 5 (3): 389–413.

Kelley, D.J., Colarelli O'Connor, G., Neck, H., Peters, L., 2011. Building an organizational capability for radical innovation: The direct managerial role. Journal of Engineering and Technology Management, 28 (4): 249–67.

Kleysen, R.F., Street C.T., 2001. Toward a multi-dimensional measure of individual innovative behavior. Journal of Intellectual Capital, 2 (3): 284–96.

Laforet, S., 2011. A framework of organisational innovation and outcomes in SMEs. International Journal of Entrepreneurial Behaviour & Research, 17 (4).

Laforet, S., 2008. Size, strategic, and market orientation affects on innovation. Journal of Business Research, 61 (7): 753–64.

Lampikoski, K., Emden, J.B., 1999. Managing innovatively: exploit creative resources. WSOY, Porvoo. (in *Finnish*)

Lawson, B., Samson, D., 2001. Developing innovation capability in organisations: a dynamic capabilities approach. International Journal of Innovation Management, 5 (3): 377–400.

Marr, B., 2007. Measuring and managing intangible value drivers. Business Strategy Series, 8 (3): 172–78.

Martensen, A., Dahlgaard, J.J., Park-Dahlgaard, S.M., Grønholdt, L., 2007. Measuring and diagnosing innovation excellence – simple contra advanced approaches: a Danish study. Measuring Business Excellence, 11 (4): 51–65.

Matsunaga, M., 2010. How to Factor-Analyze Your Data Right: Do's, Don'ts, and How-To's. International Journal of Psychological Research, 3 (1): 97–110.

McMurray, A.J., Pirola-Merlo, A., Sarros, J.C., Islam, M.M., 2010. Leadership, climate, psychological capital, commitment, and wellbeing in a non-profit organization. Leadership & Organization Development Journal, 31 (5): 436–57.

Neely, A., Filippini, R., Forza, C., Vinelli, A., Hii, J., 2001. A framework for analysing business performance, firm innovation and related contextual factors: perceptions of managers and policy makers in two European regions. Integrated Manufacturing Systems, 12 (2): 114–24.

Otala, L., 2003. Welfare to workplace – outcome to the action. Helsinki: WSOY (in *Finnish*)

Paalanen, A., Kujansivu, P., Parjanen, S., 2009. Measuring the effects of an innovation-focused intervention. In the Proceedings of the XX ISPIM Future of Innovation Conference, June 2009, Vienna, Austria.

Pavitt, K., 1984. Sectoral patterns of technical change: towards a taxonomy and a theory. Research Policy, 13 (6): 343–73.

Plehn-Dujowich, J.M., 2009. Firm size and types of innovation. Economics of Innovation and New Technology, 18 (3): 205–23.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. Journal of Applied Psychology, 88 (5): 879–903.

Romijn, H., Albaladejo, M., 2002. Determinants of innovation capability in small electronics and software firms in southeast England. Research Policy, 31 (7): 1053–67.

Sáenz, J., Aramburu, N., Rivera, O., 2009. Knowledge sharing and innovation performance - A comparison between high-tech and low-tech companies. Journal of Intellectual Capital, 10 (1): 22–36.

Salojärvi, S., 2006. Expertise, work welfare and creativity – positive spiral. In Vesterinen, P. (Ed.) Work welfare and leadership, WSOYpro, Helsinki. (in *Finnish*)

Samson, D., Terziovski, M., 1999. The relationship between total quality management practices and operational performance. Journal of Operations Management, 17 (4): 393–409.

Sen, F.K., Egelhoff, W.G., 2000. Innovative capabilities of a firm and the use of technical alliances. IEEE Transactions on Engineering Management, 47 (2): 174–83.

Shoham, A., Vigoda-Gadot, E., Ruvio, A., Schwabsky, N., 2012. Testing an organizational innovativeness integrative model across cultures. Journal of Engineering and Technology Management, 29 (2): 226–40.

Singh, R.K., Garg, S.K., Deshmukh, S.G., 2008. Strategy development by SMEs for competitiveness: a review. Benchmarking: An International Journal, 15 (5): 525–47.

Skarzynski, P., Gibson, R., 2008. Innovation to the Core: a Blueprint for Transforming the Way your Company Innovates, Harvard Business School Press.

Smith, M., Busi, M., Ball, P., Van der meer, R., 2008. Factors influencing an organisation's ability to manage innovation: a structured literature review and conceptual model. International Journal of Innovation Management, 12 (4): 655–76.

Subramanian, A., Nilakanta, S., 1996. Organizational Innovativeness: Exploring the Relationship Between Organizational Determinants of Innovation, Types of Innovations, and Measures of Organizational Performance. International Journal of Management Science, 24 (6): 631–47.

Swink, M., 2006. Building Collaborative Innovation Capability. Research-Technology Management, 49 (2): 37–47.

Tang, H.K., 1999. An inventory of organizational innovativeness. Technovation, 19 (1): 41–51.

Teece, D.J., Pisano, G., Shuen, A., 1997. Dynamic Capabilities and Strategic Management. Strategic Management Journal, 18 (7): 509–33.

Tidd, J., Bessant, J., Pavitt, K., 2005. Managing innovation: Integrating Technological, Market and Organizational Change, John Wiley & Sons, West Sussex, England.

Tura, T., Harmaakorpi, V., Pekkola, S., 2008. Breaking Inside the Black Box: Towards a Dynamic Evaluation Framework of Regional Innovative Capability. Science and Public Policy, 35 (10): 733–44.

Viitala, R., 2005. Lead expertise! Leading the expertise from theory to practice, Inforviestintä Oy, Helsinki. (in *Finnish*)

Wan, D., Ong, C.H., Lee, F., 2005. Determinants of firm innovation in Singapore. Technovation, 25 (3): 261–68.

Wang, C.L., Ahmed P.K., 2004. The development and validation of the organizational innovativeness construct using confirmatory factor analysis. European Journal of Innovation Management, 7 (4): 303–13.

Wolff, J.A., Pett, T.L., 2006. Small-firm performance: Modeling the role of product and process improvements. Journal of Small Business Management, 44 (2): 268–84.

Yang, J., 2012. Innovation capability and corporate growth: An empirical investigation in China. Journal of Engineering and Technology Management, 29 (1): 34–46

Yukl, G.A., 1998. Leadership in organizations, Prentice Hall, Upper Saddle River (N.J).

Zahra, S., George, G., 2002. Absorptive capacity: a review, reconceptualization and extension. Academy of Management Review, 27 (2): 185–203.

Zahra, S. A., George, G., 2000. Manufacturing Strategy and New Venture Performance: A Comparison of Independent and Corporate Ventures in the Biotechnology Industry. The Journal of High Technology Management Research, 10 (2): 313–45.