

Radical Versus Incremental Innovation: The Importance of Key Competences in Service Firms

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“ *A manager is responsible for the application and performance of knowledge.* ”

Peter Drucker (1909–2005)
Author and Management Consultant

Today, innovation often takes place using open practices and relies on many sources for knowledge and information. The purpose of this article is to study how different knowledge-based antecedents influence the ability of service organizations to innovate. Using data about the Norwegian service sector from the 2010 Community Innovation Survey, we examined how three types of competence, namely R&D activities, employee-based activities, and customer-related activities, influence the propensity of firms to introduce radical or incremental innovations. The results show that R&D-based competence is important for service firms when pursuing radical innovations, whereas employee-based activities such as idea collaboration are only found to influence incremental innovations. The use of customer information was found to be an important driver for both radical and incremental innovations. The findings points to managerial challenges in creating and balancing the types of competence needed, depending on type of innovation targeted by an organization.

Introduction

Studies of service innovation have increased along with the growth of the service sector, and they have emerged from being marginal and neglected to achieve recognition as an important field to study (Miles, 2000). Until recently, this research field has to a great extent been divided between two contrasting approaches: demarcation and assimilation (Coombs & Miles, 2000). The demarcation approach assumes that services are different from goods, and it is in need of its own theoretical framework to fully understand the concept and process of innovation in services. The assimilation approach, on the other hand, sees innovation (whether it is goods or services) within the same framework of understanding (Coombs & Miles, 2000; Drejer, 2004). However, these two traditions are the subject of ongoing debate, and a third perspective – the synthesis approach – has been suggested in the literature. The purpose of the synthesis approach is to create both a theoretical and an empirical approach to innov-

ation that is able to capture all economic activities – both services and industrial activities – without favouring one over the other (Drejer, 2004). Therefore, the synthesis approach focuses on the need to study service innovation from a perspective that includes the central aspects of service production at the same time, not just reflecting the manufacturing-service dichotomy (Drejer, 2004; Ordanini & Parasuraman, 2011). The perspective assumes similar underlying mechanisms of innovation, though acknowledging that the importance of the dimensions may vary depending on context, both between and within the sectors (Nijssen et al., 2006). Given that the study of service innovation is still considered to be in a relatively early stage of development (Drejer, 2004), this article aims to gain more knowledge on innovation activities within the service sector. However, the study will be based on a model that is in line with Drejer (2004) and includes elements that are assumed to be of relevance regardless of industries, and thus aims to contribute to the synthesis approach.

The Importance of Key Competences in Service Firms

Marit Engen and Inger Elisabeth Holen

According to Hult, Hurley, and Knight (2004), a firm's capacity to innovate is among the most important factors that impact its performance. Yet, little is known about the drivers of innovativeness in general (Hult et al., 2004), and empirical findings are both limited and inconclusive regarding the antecedents to innovation in services in particular (e.g., Ordanini & Parasuraman, 2011). In this article, a framework that includes antecedents to innovation and how they influence the capacities of service firms to innovate is proposed and tested. More precisely, building on the existing literature, we have identified three forms of competence (e.g., knowledge and skills) that are related to innovation activities of firms: i) R&D-based competence; ii) employee-based competence; and iii) customer-based competence. Furthermore, we distinguish between innovations based on their degree of novelty, and we examine how the different competences influence the propensity of service firms to introduce innovations that can be considered as being either radical or incremental.

The article makes two main contributions. First, the study suggests that different types of competence have varying influence over the ability of firms to introduce radical versus incremental innovations. Thus, managing the innovation process requires knowledge about how to balance the competences and exploit them differently depending on the innovation objective. Second, the findings indicate that R&D activities, although often described as being more relevant to innovation in manufacturing, are an important determinant to radical innovation in service firms.

The article is structured as follows. First, we introduce the theoretical background for the framework developed for the study. Second, we present the model and the research hypotheses, followed by the research method. Finally, we report and discuss the results, including their implications for management.

Theoretical Background

All definitions of innovation include the development and implementation of something new (de Jong & Vermeulen, 2003). An ongoing debate in the literature is the question of the degree of novelty and how "novel" should be understood. The concepts of radical (or discontinuous) innovation and incremental innovation can be seen as representing opposite ends of a novelty spectrum (de Brentani, 2001). Radical change was

defined by Tushman and Romanelli (1985) as "processes of reorientation wherein patterns of consistency are fundamentally reordered." Although there are other definitions of the concept, the common feature is the effect of the change on the resources or technology in the organization. Incremental innovation, representing the other end of the spectrum, is characterized as a change that implies small adaptations to the status quo (Tushman & Romanelli, 1985), and it is often described as a step-by-step process.

Innovations in services are commonly characterized as being incremental (Sundbo & Gallouj, 2000). The innovations are often connected to the service process, and the development of the ideas is thus partly intertwined with the organizational structures and processes in the company. However, although the innovation is characterized as evolutionary in nature, the sum of the changes may well require major reallocation of resources or technology, and consequently be towards the radical end of the novelty spectrum. Hence, there is a need to separate how ideas and innovations emerge from their actual outcomes (e.g., Toivonen & Tuominen, 2009), recognizing that diverse innovation processes may lead to the implementation of ideas ranging from incremental to radical changes. The line of separation between when an innovation is categorized as incremental versus radical can be unclear. However, incremental innovations are typically represented by, for example, minor adaptations to the existing service concept or service delivery process, whereas radical innovations often imply changes that have a significant impact on a market, for example, changing the structure of the market or creating a new market.

Antecedents to innovation

Innovations depend on multiple factors that influence the process from idea generation through development to implementation. Sundbo and Gallouj (2000) describe it as an interactive process, depending on both external and internal factors. According to these authors, innovation in service firms is primarily driven by internal forces, which are defined as: i) the management and strategy of the firm; ii) employees at all levels of the firm; and iii) R&D departments – with the first two seen as the main factors. The external forces are divided into trajectories and actors. The former refers to ideas and logic that are diffused through social systems, whereas the latter corresponds to key market actors such as customers, suppliers, and competitors, with customers usually being identified as the most crucial.

The Importance of Key Competences in Service Firms

Marit Engen and Inger Elisabeth Holen

The two internal factors – i) employees and management and ii) strategy – are emphasized as the most important in the innovation process (Sundbo & Gallouj, 2000). Managers need to be able to balance and lead the process while ensuring that the innovations fit within the chosen strategy. The importance of incorporating employees' knowledge in service innovation is also consistent with the literature (de Brentani, 2001; Ordanini & Parasuraman, 2011). Employees gain valuable knowledge from the interaction with customers through their mutual participation in the service delivery process.

Along with the internal drivers, innovation processes are said to depend on external knowledge, in particular customer-related knowledge. The customers play an active part in the service delivery process, and the value of gaining customer knowledge is well established in the literature, both for the general performance of organizations and for innovations in particular (Matthing et al., 2004; Slater & Narver, 2000). In recent literature, customers have been defined as co-creators of value (e.g., Vargo & Lusch, 2008), and a current research topic is how customers can play a more active part in the innovation processes of firms (e.g., Edvardsson et al., 2010).

Research Framework and Hypotheses

Based on the background above, we developed a research framework that incorporates three types of competence that are described in the literature as highly

relevant antecedents to innovation. These antecedents are presumed to affect the ability of service firms to introduce innovations along the spectrum of novelty. Notwithstanding the continuous nature of this spectrum, following Menton (2011), we classified novelty into one of two categories: *radical innovations*, which have a high degree of novelty, and *incremental innovations*, which have a low degree of novelty. The framework is illustrated in Figure 1, and the rationale and hypotheses for the model are addressed next.

R&D-based competence

According to Sundbo and Gallouj (2000), a model describing a typical pattern for innovation in services is relying on employees acting as corporate entrepreneurs influenced by management to regulate and control this internal entrepreneurial process. In their model, traditional R&D departments play less important roles as drivers of innovation. However, their study also showed that the pattern of innovation in services varies within the sector, depending on the line of business. Although R&D-based knowledge is generally more relevant to manufacturing (e.g., Tether, 2005), recent studies found that R&D investments and activities are also important in service firms (Leiponen, 2012; Trigo, 2013). In view of the somewhat inconsistent findings regarding R&D, R&D-based knowledge and its potential influence on innovation are considered worthy of further investigation. Hence, we have included the investigation of this aspect as part of this study. Because R&D departments are rarely found in service firms (Sundbo & Gallouj, 2000), we divided R&D-related knowledge according to wheth-

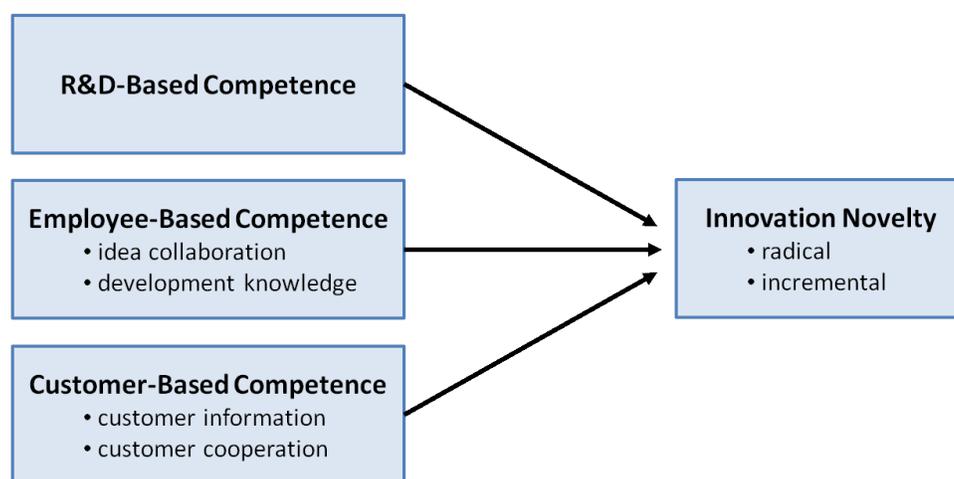


Figure 1. Research framework of determinants of innovation and novelty

The Importance of Key Competences in Service Firms

Marit Engen and Inger Elisabeth Holen

er it originated from an in-house department or was externally acquired. In line with the study of Nijssen, Hillbrand, Vermeulen, and Kemp (2006), who found that R&D strength influenced the degree of novelty of new services, we defined the following hypothesis:

Hypothesis 1a: *Internal R&D-based competence is positively related to firms introducing radical innovations.*

Hypothesis 1b: *External-R&D based competence is positively related to firms introducing radical innovations.*

Employee-based competence

Several studies have found that the involvement of employees in the innovation processes is important for successful innovation (de Brentani, 2001; Ordanini & Parasuraman, 2011; Sundbo, 2008). The employees interact with customers and so are in positions to learn from customers. Thus, they may come up with new ideas, and employees' creative ideas are known to be important in organizational innovation (Zhou & Woodman, 2003). However, employees' knowledge and ideas need to be transferred within the organization if they are to be adopted by management, so interaction between individuals is thought to be important for successful innovation. Hence, management would be wise to facilitate a work environment for employees to interact and collaborate (e.g., Shalley & Gilson, 2004). According to Gwinner, Bitner, Brown, and Kumar (2005), employees can continuously adapt and customize the services provided, thereby creating innovations through evolutionary change. Ordanini and Parasuraman (2011) also found employee collaboration to contribute to innovation radicalness, hence:

Hypothesis 2a: *Employee idea collaboration is positively related to firms introducing radical innovations.*

Hypothesis 2b: *Employee idea collaboration is positively related to firms introducing incremental innovations.*

The innovation process is knowledge intensive, and the need for skilled employees is not limited to the R&D function (Leiponen, 2005). The innovation process in service organizations is often characterized as being a broad process, wherein many individuals and departments of the organization are involved. The employees may need to acquire new knowledge in order to participate in the development and implementation of the ideas. Thus, management needs to ensure that the em-

ployees have the skills necessary to fulfil these tasks. The concept of development knowledge is applied in the study by referring to the competence building of employees related to the innovation activities of the firm. Hence;

Hypothesis 3a: *Development-based knowledge is positively related to firms introducing radical innovations.*

Hypothesis 3b: *Development-based knowledge is positively related to firms introducing incremental innovations.*

Customer-based competence

Customer-related knowledge plays an important role in the innovation processes of firms. However, it has also been argued that firms should, to some extent, view customers as partners in the innovation process (Alam & Perry, 2002; Edvardsson et al., 2010). Consequently, customer-based competence can be divided according to how the knowledge is created, either by gaining information from the customers or by collaborating with them.

Although customers are conceptualized as significant for innovation, previous studies have yielded inconclusive results about the effects of their contributions. Ordanini and Parasuraman (2011) found that collaboration with customers enhanced the capacity of firms to generate new ideas, but did not affect the degree of radicalness of the innovations. On the other hand, Mention (2011) found a positive relationship between using customer-based information and novelty of innovations but no effect from co-operating with the customers on novelty. In view of this uncertainty, we formulated the following hypotheses:

Hypothesis 4a: *Use of customer-based information is positively related to firms introducing radical innovations.*

Hypothesis 4b: *Use of customer-based information is positively related to firms introducing incremental innovations.*

Hypothesis 5a: *Customer-based co-operation is positively related to firms introducing radical innovations.*

Hypothesis 5b: *Customer-based co-operation is positively related to firms introducing incremental innovations.*

The Importance of Key Competences in Service Firms

Marit Engen and Inger Elisabeth Holen

Method

The study is based on data from the 2010 Community Innovation Survey (CIS, 2010), which was conducted in Norway for the years 2008 to 2010. The data were collected by Statistics Norway. The CIS originated in the early 1990s as an initiative of the Organisation for Economic Co-operation and Development (OECD; oecd.org), and it resulted in the development of an innovation manual that became known as the Oslo Manual (OECD, 2005). The statistical unit in the CIS survey is the firm or enterprise.

The study was based on cross-sectional data. The original sample included 3330 Norwegian service firms. However, organizations with fewer than 10 employees answered a less extensive questionnaire, which was not adequate for our purposes, and so have been omitted. Thus the results will be biased towards the larger firms. The final sample consisted of 2636 firms.

The data were analyzed using a multinomial regression (see Appendix 1). The dependent variable in our study is innovation novelty (see Figure 1). This variable is defined as having three possible outcomes: i) radical innovation, ii) incremental innovation, or iii) no innovation. By including the firms that reported not having introduced any innovations during the timespan of the survey, we are able to study the differences not just from incremental to radical, but also what distinguishes firms engaging in innovation from those who do not.

The independent variables were defined as R&D-based competence, employee-based competence, and customer-based competence. For details concerning model variables, descriptive statistics and results, see Appendix 1.

Results

Each of the three types of competence was used by the firms in the group reporting no innovations at all in the period, but to a lesser extent for all types than firms in the other two categories. The results also showed that firms introducing radical innovations used customer information as a source to a greater extent than the incremental innovators. Likewise, cooperation with customers was far more common in firms engaged in radical innovation than among the incremental innovators and non-innovators.

Out of the ten hypotheses, eight were confirmed. The regression results (see Appendix 1) show that R&D-

based competence, both internal and external, increased the probability of a service firm introducing novel innovations, thereby confirming Hypotheses 1a and 1b. Hypotheses 2a and 2b reflected the view that idea collaboration would influence innovations at both extremes of the innovation novelty spectrum. However, only incremental innovation was found to benefit from idea collaboration among employees, thus, Hypothesis 2a is not supported. Hypotheses 3a and 3b, which relate to how employees throughout the organization need knowledge to contribute to the development and implementation of innovations, were shown to influence both incremental and radical innovations, thus confirming both hypotheses. Regarding customer competence, Hypotheses 4a and 4b were fully supported. The use of customer-based information increased the probability of introducing both incremental and radical innovations. Cooperation with customers only seems to influence firms introducing radical innovation, thus supporting Hypothesis 5a; however, the hypothesized relationship to incremental innovation was not significant.

The model controlled for firm size (i.e., number of employees) and export orientation. The coefficients for firm size were not significant, whereas export orientation reduced the probability of not implementing innovations at all.

Discussion and Conclusions

This study has focused on how antecedents to innovation, here identified as R&D, employee and, customer-based competence, influence the capacities of service firms to innovate, including both ends of the novelty continuum: radical versus incremental innovation. The study does not address whether the innovation activities and the extent of innovativeness, as is measured here, are based on a firm's strategic decision. That is, a firm might strategically decide not to use resources to engage in innovation whether radical or incremental. This study merely discusses the type of competences that influence innovation and novelty, and not the possible reasons why firms choose not to innovate.

Our findings contribute to our understanding of innovation in services in several ways. First, our findings raise some questions about the assumption that innovations in service firms rarely depend on R&D (e.g., Sundbo & Gallouj, 2000). The findings indicate that R&D-related knowledge is an important driving force for service organizations when developing radical changes, thus confirming recent research on service firms' reliance on

The Importance of Key Competences in Service Firms

Marit Engen and Inger Elisabeth Holen

R&D knowledge (Leiponen, 2012). The results contribute to the synthesis approach in innovation literature, which upholds the need for studying service innovation from a perspective that includes elements assumed to be of relevance regardless of industry (e.g., Drejer, 2004).

Second, the results confirm the general notion in the service innovation literature that skilled employees make important contributions to the innovation capacity of organizations. However, the findings also add to the ambiguity regarding the effects of employees collaborating on innovation. Collaboration was expected to influence both the extent and novelty of innovations, but was found to be significant only for incremental innovation. It may be that the measure of collaboration in idea generation we used in this study is more reflective of exploitation of knowledge and therefore leads to incremental changes, rather than reflecting increased knowledge that can contribute to radical change.

Finally, the findings confirm the importance of using customer information when innovating. In line with previous studies (e.g., Evangelista, 2006) customer-related information was found to influence both radical and incremental innovation. However, collaboration with customers was found to effect only radical change. It may be that incremental innovation is largely driven by internal processes and knowledge held by employees.

In summary, the results indicate that there are differences in how various kinds of competence influence the ability of firms to introduce radical versus incremental innovations. R&D-based knowledge appears to be more important when pursuing changes with a high degree of novelty, whereas employee-related competences, as in idea collaboration, play a larger role in incremental changes. The findings all points to managerial challenges in creating and balancing the competences needed.

Managerial implications

From a practical perspective, the results obtained imply that the processes leading to radical versus incremental innovations rely on different kinds of competence. To align with a chosen strategy for innovation, managers

need to understand what knowledge to invest in and what ways of generating ideas to pursue. The results suggest that R&D-based knowledge is not as relevant for developing incremental innovation, as it is when developing and implementing radical changes, here defined as new to the market for services. Furthermore, the results suggest that the R&D-based knowledge does not need to originate from a firm's own departments, because such knowledge can also be externally acquired. Consequently, managers of service firms should consider how a more systematic approach to the R&D-based knowledge may benefit their innovation efforts if radical changes are the goal.

The results also point to the role of employees in the innovation processes. Ensuring that employees throughout the organization have the knowledge necessary to contribute to the innovation process and to implement the change is related to both ends of the novelty scale. Given that innovations in services often extend across departments, it is important that management invest in the employees' knowledge in general, to broaden the knowledge base within firm.

Finally, the results confirm the importance of the ability of firms to continuously collect and use information from customers in order to contribute to, and facilitate, the innovation effort. New services must be developed in response to customers' needs if they are to succeed, and it is important that managers have systems in place to continuously collect market information and disseminate it within the organization as part of knowledge sharing. Moreover, managers should also find ways to engage in collaborating activities with customers when pursuing radical innovations. It seems that customers may be able not only to evaluate present service offers, but they can also contribute with more radical ideas for new services. Thus, creating ways to cooperate better with customers may be essential to the capacity of the firm to innovate.

To conclude, innovations in service firms will benefit from the use of knowledge from a diversity of sources, internally and externally, making it important for managers to have a strategy that balances the type of competences, as well as the ability to exploit them in pursuit of different innovation objectives.

The Importance of Key Competences in Service Firms

Marit Engen and Inger Elisabeth Holen

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The Importance of Key Competences in Service Firms

Marit Engen and Inger Elisabeth Holen

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Appendix 1: About the Research

The categories of innovation in the CIS survey were based on Schumpeter's (1934) original categories of product, process, organizational, and marketing innovation. The different categories were coded as binary (yes/no). The survey did not use the notions of radical or incremental innovation. The questions were framed to discover whether the product or process innovations were new to the market or new to the firm. According to de Brentani (2001), the degree of novelty can be defined using these two categories, where "new to the market" describes a higher degree of innovativeness compared to "new to the firm". Hence, we defined the group of radical innovators to consist of the firms that had introduced a product or service new to the market or a process innovation new to the market in the period from 2008 to 2010, whereas the group of incremental innovators consists of the firms that had introduced products, services, or processes, or that had been engaged in organizational or market innovation only new to the firm, in the same period. A similar categorization of innovation novelty has been used on CIS data by other researchers (e.g., Mention, 2011). The last group of non-innovators consists of the firms that had reported no innovation at all in the three-year period.

A description of the dependent and independent variables and how they are modelled is shown in Table 1.

Both internal R&D and external R&D were included as separate, binary variables in the model as measures of R&D-based competence.

Employee-based competence was evaluated with two measures. First, development-based knowledge was handled with a binary variable reflecting whether or not the firm had engaged in competence building for the purpose of developing or implementing new or enhanced products or processes. Second, we modelled employee collaboration via two binary variables, one capturing the firm's successful use of idea-brainstorming groups, and the other measuring the use of interdisciplinary work groups intended to stimulate new ideas.

Customer-based competence was modelled with a variable for the use of information and cooperation. The original survey scale on information use ranged from 0 for no use to 3 for great importance. To avoid an interval scale interpretation of an ordinal scale, the scale was reduced to a binary scale for the analysis with the value 1 for high or medium importance and 0 for low importance or no use. The customer-based cooperation was also measured using a binary scale.

In addition to the variables directly connected to the firm's innovation activities, two control variables were included: i) firm size, in terms of the number of employees, and ii) export orientation.

Model specification

Even though the outcomes of our dependent variable, innovation novelty, could be seen as ordered in degree of newness, the "distances" between the categories are not likely to be equal. Thus, the assumption of parallel regressions could be violated, so that ordinal regression will not be the appropriate choice (e.g., Long & Freese,

The Importance of Key Competences in Service Firms

Marit Engen and Inger Elisabeth Holen

2006). The Wald-test gives a p-value of 0,000 as evidence for rejecting the null hypothesis that the coefficients are equal across the categories of innovators. A second alternative is estimation of binary logistic regressions for all comparisons among the alternatives of the dependent variable, but a problem of doing so is that each binary logit is based on a different sample. Although our main interest is in the differences between service firms engaged in incremental and radical innovation respectively, we also want to compare the innovative firms with the firms that have not introduced innovations at all. Hence, we used multinomial logit regression to estimate the model, specifying firms engaged in incremental innovation as the base category.

Table 2 presents descriptive statistics for our model variables. The sample distribution on the dependent

variable is 19.5% of the service firms introducing radical innovations and 22.2% using incremental innovations, which leaves 58.3% of the firms with no innovations at all between the years 2008 and 2010.

Regression results

The parameter estimates of the multinomial regression model are presented in Table 3. The overall accuracy of the model is relatively good (pseudo $R^2 = 0.3433$). Because incremental innovation is defined as the base category, the reported coefficients in Table 3 for radical innovation and no innovation are both estimated in comparison to incremental innovations. The discussion of the results below Table 3 is however presented in line with the hypotheses, referring to expected outcome on radical and incremental innovation.

Table 1. Description of the variables included in the model

Variable Type	Description	Range
Dependent	<i>Innovation novelty</i> (0= no innovation, 1=incremental innovation only, 2= radical innovation)	0–2
	<hr/>	
Independent	<i>R&D-based competence</i>	
	Internal R&D (1 if used internal R&D, 0 otherwise)	0–1
	External R&D (1 if used externally acquired R&D, 0 otherwise)	0–1
	<i>Employee-based competence</i>	
	Idea collaboration (1 if used brainstorming/interdisciplinary work groups, 0 otherwise)	0–1
	Development knowledge (1 if used internal competence building, 0 otherwise)	0–1
	<i>Customer-based competence</i>	
	Customer-based information sources (1 if used, 0 otherwise)	0–1
	Customer-based co-operation (1 if used, 0 otherwise)	0–1
	<hr/>	
Control	Export orientation (1 if firm was exporting, 0 otherwise)	0–1
	Size (number of employees)	10–16700

The Importance of Key Competences in Service Firms

Marit Engen and Inger Elisabeth Holen

Table 2. Descriptive statistics for model variables

Variable	No Innovation	Incremental Innovation	Radical Innovation
Number of firms	1537	586	513
% of firms in each group	58.3	22.2	19.5
<i>R&D-based competence</i> (% with use within each group)			
Internal R&D	5.7	29.0	76.4
External R&D	1.8	11.1	33.9
<i>Employee-based competence</i>			
Idea collaboration	24.2	68.3	82.5
Development knowledge	2.5	29.5	69.2
<i>Customer-based competence</i>			
Customer-based information sources	22.0	69.6	90.6
Customer-based cooperation	0.9	5.5	22.0
<i>Control variables:</i>			
Export orientation	28.7	43.1	58.1
Number of employees (mean/std.dev)	92/215.59	160/788.45	120/350.57

The Importance of Key Competences in Service Firms

Marit Engen and Inger Elisabeth Holen

Table 3. Multinomial regression: type of innovation by independent variables

	Radical Innovation	No Innovation
<i>R&D-based competence</i>		
Internal R&D	1.335 (0.173)***	-0.248 (0.192)
External R&D	0.441 (0.185)*	-0.302 (0.283)
<i>Employee-based competence</i>		
Idea collaboration	-0.043 (0.174)	-1.176 (0.122)***
Development knowledge	0.806 (0.157)***	-1.735 (0.211)***
<i>Customer-based competence</i>		
Customer-based information sources	0.512 (0.204)*	-1.306 (0.125)***
Customer based cooperation	0.582 (0.231)*	0.234 (0.374)
<i>Control variables</i>		
Export orientation	-0.025 (0.146)	-0.270 (0.121)*
Number of employees	-0.000 (0.000)	-0.000 (0.000)
Constant	-1.747 (0.201)***	2.440 (0.104)***
Pseudo R ²	0.3433	
Number of observations	2636	

Note: Unstandardized multinomial regression coefficients, robust standard errors in parentheses. Significant at * p<0.05, ** p<0.01, *** p< 0.001. Incremental innovation is the base category.

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