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ABSTRACT AND KEYWORDS	
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Knowledge management as a strategic tool to foster innovativeness of SMEs

Haibo Zhou^a, Lorraine Uhlaner^{bc}

^a Erasmus University Rotterdam, hzhou@ese.eur.nl

^b Nyenrode Business Universiteit, l.uhlaner@nyenrode.nl

^c Max Planck Institute for Economics, Jena, Germany

Abstract: This study examines the relationship between knowledge management (KM) (in terms of external acquisition and internal sharing) and innovation behavior. The concept of absorptive capacity and assumptions from the dynamic capabilities view underlie the proposed framework and hypotheses. The framework is empirically tested using a random sample of 649 Dutch small to medium sized enterprises (SMEs). Our empirical results indicate that external acquisition practices play a key role in fostering SMEs' innovativeness while internal sharing practices do not appear to have a significant influence. External acquisition activity enhances a firm's awareness of available knowledge opportunities. Firms which actively acquire external knowledge (regardless of the type of knowledge) may build a greater competitive dynamic capability to sense and seize business opportunities which in turn may lead to new or improved products or processes. We suggest that owners/entrepreneurs of SMEs and their firms will benefit in the long term if they strategically manage knowledge, especially using external acquisition practices.

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Correspondence: Haibo Zhou: hzhou@ese.eur.nl

INTRODUCTION

Today, firms must shift focus to knowledge-based economic activities in order to compete in the highly dynamic and globalized environment (Audretsch and Thurik, 2000, 2001, 2004). Due to its 'difficult-to-replicate' character, knowledge is regarded as a significant source of competitive advantage to foster a firm's innovativeness (Corso *et al.*, 2003; Chirico, 2008). Drawing from the resource-based and dynamic capabilities (DC) views, a firm can sustain its competitive advantage by exploiting its resources (i.e., knowledge assets) and organizational capabilities (Grant, 1996; Kogut and Zander, 1993; Nonaka and Takeuchi, 1995; Spender, 1996). Resources alone however are insufficient to assure a firm's success. Rather, as stressed by the DC perspective, a firm's abilities to renew and develop its existing organizational capabilities, referred to as its dynamic capabilities due to the on-going need to update and adapt such capabilities to internal and external changes, are also essential for building and sustaining competitive advantage (Eisenhardt and Martin, 2000; Teece, Pisano and Shuen, 1997). The creation and evolution of dynamic capabilities in turn depends on knowledge management, that is, practices which accumulate, transfer and apply such knowledge within the firm (Eisenhardt and Martin, 2000; Zolle and Winter, 2002).

Knowledge management encompasses not only the related notions of knowledge transfer and knowledge sharing (externally from other firms to the small firm and/or internally among firm members), but the entire knowledge acquisition and utilization process, beginning with locating and capturing knowledge (including tacit knowledge which is difficult to codify), and followed by the enabling of that knowledge within the firm (Choo and Bontis, 2002; Takeuchi and Nonaka, 2004). As defined in the present study, *knowledge management* refers more specifically to a set of organizational routines and processes by which knowledge can be acquired, shared, transferred and exploited in the firm. These routines or processes contribute to the firm's ability to value new external knowledge, assimilate knowledge and apply it to commercial ends, an ability referred to by Cohen and Levinthal (1989) as *absorptive capacity*. Although some researchers use the two concepts interchangeably (for instance, Zahra and George, 2002), in this study, knowledge management is viewed as creating the potential for absorptive capacity but not viewed as the same construct. The model presented in the current study argues that the quality of a firm's absorptive capacity depends, at least in part on the appropriateness of its knowledge management. An examination of the

literature suggests that knowledge management and absorptive capacity should be two closely related concepts, and research to date does not clarify the theoretical relationship between the two concepts. The first contribution of this study is to elaborate upon these two constructs in an integrated model.

The present paper also examines the possible relationships between certain aspects of knowledge management and a firm's *innovation behavior*—that is, the extent to which the firm develops and/or introduces new products or services. Research over the past thirty years repeatedly shows patterns that a disproportionate amount of innovation (including new patents and other inventions and discoveries) comes from SMEs (Acs, 1996; Thompson and Leyden, 1983). Therefore, it is of special interest how SMEs perceive and practice knowledge management to foster innovation within their own firms (Prince and Becht, 2000). Relatively limited attention has been paid to understand knowledge management for SMEs and to its contribution to innovation in particular (Sparrow, 2001; Wong and Radcliffe, 2000). Studies that have been carried out typically rely upon either qualitative methods and/or fairly small samples. The second contribution of this study is thus to provide insight into how knowledge management contributes to innovation behavior of SMEs using quantitative methods applied to a large random sample of Dutch SMEs.

Third, in addition to the concepts of knowledge management, absorptive capacity and innovation behavior, the current paper examines the role of innovation orientation as a mediating variable between knowledge management and innovation behavior in the research framework. Though the term has been used variously to refer to a firm's openness to new ideas, and/or its capacity to introduce a new product, process or idea (Burns and Stalker, 1977; Hult, Hurley and Knight, 2004; Hurley and Hult, 1998; Zaltman, Duncan and Holbek, 1973), as used here, it refers to the intention to a firm's strategy or intention to develop new products, services or processes or to renew or improve existing products, services or processes (Homburg, Hoyer and Fassnacht, 2002; Kundu and Katz, 2003; Worren, Moore and Cardona, 2002).

This article is structured as follows. First, we explore the theoretical background of our key concepts, which are knowledge management, absorptive capacity, innovation orientation and innovation behavior. Second, a conceptual framework of this study is introduced and hypotheses for testing are delineated. Third, we discuss the research methodology regarding sampling, measures and model tests. Fourth, the results of empirical analysis are presented and discussed in detail and the key findings are

highlighted. Last, we conclude this article with implications and opportunities for future research.

THEORETICAL BACKGROUND

Knowledge Management in SMEs

Knowledge management has been studied by several disciplines from different approaches (Lopez, Montes Peón and Vázquez Ordás, 2004). Drawing upon the resource-based view (Barney, 1991), for instance, a firm needs to hold and manage knowledge in the form of established procedures, patents, training patterns or organization routines in order to sustain its competitive advantage. According to some researchers, this ability can be exploited better via economics of scale and continuity (Thorpe *et al.*, 2005). However, SMEs are not able to command economies of scale in the same way as larger organizations due to their lack of size and financial scope (Desouza and Awazu, 2006). Knowledge in SMEs is gained through the experiences and associated tacit and explicit learning of specific individuals (Carson and Gilmore, 2000; Wong and Radcliffe, 2000). Wiklund and Shepherd (2003) suggest that SMEs highly rely on individual know-how, especially that of the entrepreneurs and managers in the firm. Recent findings from Zhou, Tan and Uhlaner (2007) confirm this conclusion and find that the owner/entrepreneur plays an important role in knowledge sharing in 68% of their sample.

Knowledge management encompasses not only the related notions of knowledge transfer and knowledge sharing (externally from other firms to the small firm and/or internally among firm members), but also the entire knowledge acquisition and utilization process, beginning with locating and capturing knowledge (including tacit knowledge which is difficult to codify), and followed by the enabling of that knowledge within the firm (Choo and Bontis, 2002; von Krogh, Ichijio and Nonaka, 2000; Takeuchi and Nonaka, 2004; Uhlaner and Van Santen, 2007; Uit Beijerse, 1999). In spite of a growing literature, the operationalization of these different concepts and in particular the differentiation between such concepts as enabling knowledge and innovation behavior is rather difficult for respondents to discern (Blom *et al.*, 2006; van Rijnsouw, 2005). The scope of the present study is thus limited to two aspects of the knowledge management and represents a more simplified approach than represented in these models. The two aspects include external acquisition and internal sharing of knowledge.

Instead of creating knowledge in-house, for instance through research and development activities, many SMEs acquire new knowledge through individual interaction or social ties from external sources. Knowledge can be transferred either by individuals directly, for instance via the acquisition of a new worker who brings in knowledge and experience into the firm and/or exchange of information between existing employees and external contacts. Exploiting external sources of knowledge is a key practice for SMEs probably in part due to their resource constraints (Desouza and Awazu, 2006). Zhou *et al* (2007) report that more than half of their sample acquires new knowledge through a connection with external professionals for instance.

Internal sharing is also identified as a form of knowledge management in SMEs. In an intensive qualitative investigation of 25 SMEs, Desouza and Awazu (2006) find that socialization is a dominant factor in the knowledge management cycle. Socialization helps move knowledge in tacit form between individuals. Common knowledge, thus created, eases the knowledge transfer and application of such knowledge by providing a shared foundation for interpretation and communication. Desouza and Awazu (2006) also find that SMEs tend to manage knowledge in people-based rather than technology-based approaches. Based on other research by Zhou *et al* (2007), approximately 80% of the Dutch SME sample reports that knowledge is shared via face-to-face communication. The reason for the emphasis on these people-based approaches may be due to the fact that much of the knowledge in SMEs remains tacit. Given its lack of codification, tacit knowledge can be more easily *externalized*, that is the process for unlocking tacit knowledge and making it explicit (Nonaka and Toyama, 2003), through discussion among colleagues as well as by connecting with experts and other organizations (Davenport and Prusak, 1998; Nooteboom, 2001).

Absorptive Capacity

The term, absorptive capacity, was first introduced by Cohen and Levinthal (1989). As originally defined, absorptive capacity refers to the firm's ability to value new external knowledge, assimilate it and apply it to commercial ends (Cohen and Levinthal, 1990). Kim (1998) further proposes that absorptive capacity is a learning capability and problem-solving skill that enables a firm to assimilate knowledge and create new knowledge. In keeping with Kim's definition, in this paper, absorptive capacity is not limited to the assimilation of external knowledge but can also include the ability to

value and assimilate internally-generated knowledge. Either way, the literature suggests that absorptive capacity is crucial for a firm's innovation behavior. Although absorptive capacity continues to be a topic of discussion in the literature, its operationalization is still fuzzy (Kim, 1998; Lane, Koka and Pathak, 2006; Todorova and Durisin, 2007; Zahra and George, 2002). Especially in the research on larger firms, researchers often choose to measure absorptive capacity by measuring the level of investment in research and development (Cohen and Levinthal, 1994). However, it is not obvious to the authors that the level of R&D investment is a proper operationalization of absorptive capacity given the commonly held definitions of the latter as the ability to value, assimilate and/or apply knowledge to products or services, but only rather, as one of the its possible antecedents. And even if one could agree with the rationale that R&D expenditure is a good measure of absorptive capacity in large firms, it would seem inappropriate in any case in the context of SMEs, given the relatively limited amount of formal R&D that takes place in the majority of SMEs.

Zahra and George (2002) attempt to address this issue by contrasting the concepts of *potential* and *realized* absorptive capacity. Zahra and George (2002) for instance, refer to the organizational routines and processes which may enhance the firm's ability to assimilate knowledge as potential absorptive capacity whereas the actual ability itself refers to realized absorptive capacity. Though this distinction is not yet universally adopted by all writers on absorptive capacity (e.g. Jansen, van den Bosch and Volberda, 2005; Lane *et al.*, 2006; Todorova and Durisin, 2007), we find the distinction useful. In particular, what Zahra and George (2002) refer to as potential absorptive capacity really describes the function of knowledge management quite well. For the purpose of our framework, we suggest that what Zahra and George (2002) call 'realized' absorptive capacity, furthermore, can then simply be referred to as absorptive capacity (See Figure 1). Note that contrary to research by others, we see the actual capabilities reflected in absorptive capacity as a latent variable that cannot be directly measured, but rather the success of which is reflected in outputs (such as new products, processes, etc.). Thus, in the present paper, we do not attempt to measure absorptive capacity directly.

Insert Figure 1 about here

Innovation Orientation and Innovation Behavior

As mentioned in the introduction, definitions of innovation orientation vary widely. Siguaw, Simpson and Enz (2006) define innovation orientation as a multidimensional knowledge structure which is composed of a learning philosophy, strategic direction and transfunctional beliefs within an organization. All three elements aim to guide the organizational strategies and actions to foster a firm's innovativeness. However, we feel that it is hard to operationalize and capture all the three dimensions into one variable. In keeping with some other researchers, we restrict our scope of innovation orientation to that of strategic direction regarding innovation, or in short, the firm's intention to innovate (Homburg *et al.*, 2002; Kundu and Katz, 2003; Worren *et al.*, 2002). We define *innovation orientation* thus as the firm's strategic intent to invest and promote innovation, and to encourage innovative thinking. This definition is consistent with the definition proposed by Worren *et al* (2002).

Innovation behavior is represented by output of new products or services developed and/or introduced by a firm. Innovation represents the utilization of knowledge in order to create something which has new economic value. In the present paper, we focus narrowly on product and/or service innovation, ignoring other classifications such as process innovation, organizational innovation, management innovation, and commercial/marketing innovation (Trott, 1998). However, research by Johannessen, Olsen and Lumpkin (2001) conclude that innovation is unidimensional, with the variation in newness or novelty being the most important. For this reason, we include innovations both new to the market and new to the company. These distinctions in theoretical terms reflect the two types of innovation originally proposed by March (1991), namely exploration and exploitation. Exploitation innovation builds on or extends the existing knowledge of a firm, while exploratory innovation requires knowledge and capabilities that are new to the firm (March and Simon, 1958; Weick, 1979). These distinctions may suggest that absorptive capacity varies in function or importance for achieving these two types of innovation behavior. Some researchers suggest that firms which create exploratory innovations, for instance often drive out firms who have lack of skills and capabilities in absorbing and combining new knowledge (Dosi, 1982; Tushman and Anderson, 1986).

RESEARCH FRAMEWORK AND HYPOTHESES

In this study, we propose that 1) engaging in knowledge management can develop absorptive capacity of a firm, which consequently contributes to innovation orientation and in turn, innovation behavior of the firm; 2) knowledge management including external acquisition and internal sharing, has a positive effect on innovation behavior of a firm; and 3) innovation orientation plays a mediating role in the relationship between knowledge management and innovation behavior. A proposed research framework summarizing these three propositions is presented in Figure 2.

Insert Figure 2 about here

Knowledge management and Absorptive capacity

In this study, we propose that enhancement of absorptive capacity is one of the underlying explanations for a positive contribution of knowledge management to innovation behavior. Both knowledge management and absorptive capacity have the same aim, which is to sustain competitive advantage and yield superior performance of a firm. However, knowledge management refers to the organizational routines and processes whereas absorptive capacity refers to the underlying ability of the firm to assimilate knowledge presumed to be enhanced by the presence of such routines and processes.

Zahra and George (2002) argue that the quality of a firm's acquisition capabilities can be determined by the intensity and speed of a firm's efforts to identify and gather knowledge. Internal assimilation capabilities results from effective sharing processes that allow the firm to analyze, process, interpret and understand the knowledge acquired from external sources (Kim, 1998; Szulanski, 1996). Internal assimilation also requires the communication of generated knowledge to all relevant departments and individuals. Either formal or informal networks need to be maximally utilized to transfer knowledge within the firm (Liao, Welsch and Stoica, 2003). Although the process perspective of absorptive capacity has been widely adopted, researchers usually fail to distinguish the organization routines enhancing a firm's absorptive capacity from a firm's actual absorptive capacity. In contrast, we distinguish between the two concepts and refer them as knowledge management practices and absorptive capacity, respectively.

The success of assimilation of knowledge (and thus ultimately, the firm's absorptive capacity), first of all, is dependent on the ability of its individual members to assimilate and process information (Cohen and Levinthal, 1990). However, a firm's absorptive capacity is also dependent on the structure of external communication and internal sharing. Zahra and George (2002) argue that effective internal knowledge sharing and integration are critical aspects of absorptive capacity. Thus, knowledge management needs to be managed at an organizational level in order to be effective enough to yield a firm's absorptive capacity. Individual abilities alone are not enough to guarantee optimal results.

Knowledge management and Innovation behavior

As mentioned in the introduction, knowledge is the key ingredient of a firm's innovation behavior. A firm can create and develop new technological knowledge in house, for instance through R&D activities. However, past research suggests that outside sources of knowledge are often critical to the innovation process (Pierce and Delbecq, 1977). Ravasi and Turati (2005) indicate that technology is generally transferred into a SME rather than developed in-house. Compared to larger enterprises, exploiting external sources of knowledge is especially important for SMEs due to their resource constraints (Desouza and Awazu, 2006). In order to obtain new external knowledge, a firm can either hire new personnel specialized in this expertise or motivate individual learning through external networks.

External acquisition represents another important means of a firm's ability to create new knowledge. Unlike "learning by doing", external acquisition allows firms to learn something different from what they already know (Cohen and Levinthal, 1989). The more external knowledge is acquired, the more existing knowledge can be reconfigured with it to yield new competitive advantages (Cohen and Levinthal, 1990). The accumulation of external knowledge can increase the possibilities of recognizing and developing new technological opportunities for the firm (Teece, 2007). External acquisition through formal and informal networks can also enhance the firm's ability to evaluate the commercial value of technological advances and to better position existing and/or new products in the market. We thus propose that external acquisition contributes to a firm's innovation behavior by enhancing a firm's ability to seize and value the technological opportunities which consequently contribute to a firm's innovation

behavior.

Internal sharing provides a framework where common knowledge can be generated. Common knowledge is important due to its role in integrating knowledge which in turn enhances a firm's ability to utilize knowledge (Grant, 1996). Common knowledge eases the barriers of knowledge transfer. It is observed that firms are required to continuously leverage and to recombine knowledge for new product development (Kazanjian, Drazin and Glynn, 2001). The effective application of new and/or existing knowledge, that is the knowledge creation process (Huber, 1991), requires understanding by individuals within the firm as well as the sharing of knowledge amongst individuals with unique or specialized skills. When the knowledge creation process within the firm becomes more efficient and routine, the cost of developing innovation will decrease, and the innovation activities in turn will increase. Therefore, internal sharing facilitates the speed and effectiveness of the innovation process (Liao *et al.*, 2003). Sharing information or knowledge through either formal or informal networks within a firm is crucial for SMEs to innovate. Both types of knowledge management can create and develop absorptive capacity of a firm which results in more innovation behavior in the SME. We sum up the aforementioned arguments as follows:

Hypothesis 1a: External acquisition activities contribute positively to innovation behavior.

Hypothesis 1b: Internal sharing activities contribute positively to innovation behavior.

The role of innovation orientation as a mediator

More generally in psychology, behavioral intentions are often viewed as a precursor for the actual behavior (Fishbein and Ajzen, 1975; Wicker, 1969). In this study, we make inferences at the aggregate level of individual intentions. Since most of our observations are small firms led by individual entrepreneurs, this is probably a reasonable assumption though we acknowledge that we are transferring this concept to a different level of analysis (individual to firm). It is thus presumed that innovation orientation, as a reflection of innovation strategic intentions, may be more directly affected by knowledge management (and absorptive capacity in turn) than would innovation behavior itself. In the present application, furthermore, a firm that is more

innovation-oriented will be presumed to devote its energy to creating new products and refining its superior innovation products (Berthon, Hulbert and Pitt, 1999).

In summary, we assume that it is more likely that firms engaging in external communication can quickly react to the changing environment—that is, that they are more likely to be open to new ideas and to perceive new opportunities—and thus more innovation oriented. Furthermore, internal sharing, another aspect of knowledge management, will likely not only create common knowledge among individuals to stimulate innovation but also facilitate innovative ideas generated by individuals during formal or informal discussions with each other. Creativeness of such individuals, at an aggregated level, should result in a higher level of innovation-orientation, in turn, at the firm level. We thus argue that innovation orientation plays a mediating role in the relationship between knowledge management (external acquisition and internal sharing) and innovation behavior.

Hypothesis 2a: Innovation orientation is likely to mediate the relationship between external acquisition and innovation behavior.

Hypothesis 2b: Innovation orientation is likely to mediate the relationship between internal sharing and innovation behavior.

METHODOLOGY

Sample and Data Collection

This paper uses a sub-sample of firm-level data from ‘SME Business Policy Panel’ that has been tracked longitudinally by EIM Business Policy and Research since 1998. The total panel consists of about 2000 SMEs and is stratified according to sectors (manufacture, construction, retail and wholesale, and service, according to BIK codes¹) and size classes (0-9, 10-49 and 50-99 employees in FTEs).

For this particular study, our independent variables (knowledge management and innovation orientation) were collected via several rounds of telephone (computer-aided) interviews in 2006. Using the same mechanism, our dependent variable (innovation behavior) was collected in 2007. A key informant approach was adopted for this study (Kumar *et al*, 1997). All questionnaires were sent to the director of SMEs. However, given the anonymity of respondents, it was not possible to recheck the real organizational roles of respondents. Thus it is difficult to determine whether informant data was distorted due to individual

characteristics (Golden, 1992). This so called single-response bias is a recognized limitation of the study.

The target group of this particular study includes only independent companies with at least four employees from all sectors. This resulted in a sample of 649 firms available for empirical analysis. Within the sample, about 50% of respondent firms are less than 18 years old; about 50% of our sample is in service sector. Regarding size, about 47% of respondent companies have 4-9 employees, about 38% of them are small enterprises with 10-49 employees and the remaining 15% have 50-99 employees. Thus, the sample is somewhat overrepresented by relatively young and small companies in service sector. However, controlling for company age, size and sector differences is expected to offset this problem, at least in part.

Models and Variables

In order to test the proposed hypotheses, we estimated the following models:

$$InnoBeh = \beta_0 + \beta_1 \cdot ExterA + \beta_2 \cdot InterS + \beta_3 \cdot Context + \varepsilon \quad (1)$$

$$InnoBeh = \beta_0 + \beta_1 \cdot ExterA + \beta_2 \cdot InterS + \beta_3 \cdot InnOri + \beta_4 \cdot Context + \varepsilon \quad (2)$$

Where *InnoBeh* represents innovation behavior variable; *ExterA* represents external acquisition variable; *InterS* represents internal sharing variable; *InnOri* represents innovation orientation strategy variable; *Context* represents general context variables.

To construct these variables, a variety of techniques, including Exploratory Factor Analysis, testing for reliability using the Cronbach-alpha reliability coefficient, correlation between the variables, a check for face validity and common method bias test, were used in combination to form the scales. Variables that required a combination of items made use of the protocol referred to as categorical principal components analysis (CATPCA) and was executed using the Statistical Package for the Social Sciences (SPSS). [Appendix A](#) provides a more extensive description of each variable.

¹ Bedrijfsindeling Kamers van Koophandel

Knowledge management, Innovation Orientation and Innovation behavior

CATPCA is used to combine items into scales for knowledge management, innovation orientation and innovation behavior (See Table 1). Items are measured on a five-point disagree/agree scale. Five items assess the intensity and direction of efforts expended in external acquisition (Cronbach's alpha= 0.80) and three items measure internal sharing (Cronbach's alpha= 0.63). These items draw from the existing literature regarding knowledge management in SMEs (Uit Beijerse, 2000; Wong and Aspinwall, 2005; Zhou *et al.*, 2007). It is also interesting to see that similar variables were used for the empirical study of the dimensions of potential absorptive capacity (Jansen *et al.*, 2005). Furthermore, CATPCA was used to construct a three item scale for innovation orientation (Cronbach's alpha = 0.62) and a three item scale for innovation behavior (Cronbach's alpha = 0.64). Although reliabilities are somewhat lower than desired, results from the common method bias test support the conclusion that each scale measures a separate construct (Podsakoff and Organ, 1986; Tippins and Sohi, 2003). More specifically, results were checked for an orthogonally rotated Principal Components Analysis (PCA) including individual items for knowledge management, innovation orientation and innovation behavior. Based on Harman's single-factor test, results provide support for the conclusion that the two knowledge management factors, external acquisition and internal sharing, innovation orientation and innovation behavior are separate factors. In the unrotated solution, the largest factor explains only 26% of total variance. Furthermore, component loadings range from .57 to .80, with an average statement loading on the intended construct of .69. Of the 42 potential cross-loadings, only 2 are above .30 (one being .41, the other .32). This provides reasonable confidence that common method bias is not a major problem in the current study. However, given limits of the methodology we cannot rule out such bias altogether (Podsakoff *et al.*, 2003).

Insert Table 1 about here

Control variables

We use company size, age and sector (manufacturing, construction, retail and wholesale, and services), as control variables in our empirical analysis. Company size is

measured by the natural logarithm of the number of employees in 2006. Four sectors are defined: manufacturing, construction, retail and wholesale, and services. Age is measured by the difference between founding year and 2006.

Data analysis

Bivariate relationships are first examined using Pearson product-moment bivariate correlation statistics. Tests for multicollinearity, using VIF scores were carried out. As a first method for testing the proposed hypotheses, we used Ordinary Least Squares multiple regression analysis. A test for mediating effects is used based on approaches by James and Brett (1984) and Baron and Kenny (1986) as follows: We first estimate three separate models: $y=f(x)$, $z=f(x)$ and $y=f(z)$. We assume the presence of a mediating effect when the following requirements are met: a) a significant effect of x on y in the model $y=f(x)$; b) a significant effect of x on z in the model $z=f(x)$; and c) a significant effect of z on y in the model $y=f(z)$. If one or more of these relationships are non-significant, we can argue that mediation is not supported. Furthermore, we estimate model: $y=f(z,x)$. If the effect of z remains significant after controlling for x , but x is no longer significant when z is added to the model, we can argue there is a full mediation. If x is still significant, it supports a partial mediation.

A Structural Equation Model

As an alternative test to the hierarchical regression analysis, a structural equation model using AMOS is used to examine the hypothesized relationships in this study. A distinct advantage of structural equation models is the inclusion of latent variables, making possible the measurement of abstract concepts that are not measurable directly. In the present study, the latent variables are two aspects of knowledge management (external acquisition and internal sharing), innovation orientation and innovation behavior.

The overall fit of structure equations model is checked by using chi-square (χ^2), degrees of freedom (df), and a probability estimate (p-value). The chi-square value should not be significant if there is a good model fit. In addition, the following indices were also commonly used to evaluate the model fit: relative chi-square or normal chi-square ($CMIN/DF \leq 3$); goodness of fit (GFI) which checks for sample size effects and should be above 0.90; CFI, a comparative fit index which checks for non-normal distribution should be above 0.90; and the

root mean square error of approximation (RMSEA), which measures population discrepancy per degree of freedom and should be below 0.05 (Hu and Bentler, 1999; Murtha, Lenway and Bagozzi 1998). When models are estimated using maximum likelihood estimation, it is appropriate to use Akaike information criterion (AIC), Bayes information criterion (BIC) and consistent AIC criterion (CAIC) to evaluate goodness of fit (Benetti and Kambouropoulos, 2006). The value of hypothesized model should be smaller than saturated model and independence model.

RESULTS

Bivariate relationships

Table 2 presents the correlations among all variables used in the study. Variance inflation factor (VIF) scores are computed for each of the regressions and range from 1.04 and 1.30, suggesting that the analysis should not be seriously distorted by multicollinearity.

Insert Table 2 about here

Knowledge management, innovation orientation and innovation behavior

Hypothesis 1a and 1b both predict a positive relationship between knowledge management and innovation behavior. Model 1 shows a significant positive coefficient for external acquisition ($B=0.17$, $p<0.01$) and a trend for internal sharing ($B=0.07$, $p<0.1$). Hence hypothesis 1a is supported. There is no significant support for hypothesis 1b (See Table 3, model 1).

Regarding Hypotheses 2a and 2b, when we add innovation orientation in model 4, the significant effect of knowledge management disappears but model 4 shows a significant positive coefficient for innovation orientation ($B=0.36$, $p<0.01$) (See Table 3, model 4). Using the test for mediating effects according to the regression analysis based technique proposed by James and Brett (1984) and Baron and Kenny (1986), we find best support for the conclusion that the relationship between external acquisition and innovation behavior is mediated fully by the innovation orientation variable. To explain, note that first of all, Model 1 (Table 3) shows that the independent variable, external acquisition, predicts innovation behavior ($B=0.17$; $p<0.01$), when the proposed

mediating variable, innovation orientation is excluded from the regression model. Note secondly, that external acquisition predicts innovation orientation, in Model 3 of Table 3 ($B=0.36$, $p<0.01$). However, the unstandardized coefficient (B) for external acquisition predicting innovation behavior drops almost to zero when innovation orientation is added to the model ($B=0.04$, ns, shown in Model 4 of Table 3). Note also that when innovation orientation alone is used in the regression equation (Model 2 of Table 3), together with the controls, it also predicts innovation behavior ($B=0.38$, $p<0.01$) meeting the final requirement for mediation. Taken together, these findings are consistent with the conclusion that innovation orientation functions as a mediating variable, in the relationship between external acquisition and innovation behavior. Reviewing similar results for internal sharing, the results are more ambiguous. There is a trend such that internal sharing is positively associated with innovation behavior, but not at the level of statistical significance ($B=0.07$: $p<0.1$, in Model 1 of Table 3). Furthermore Internal sharing is not associated with the mediating variable, innovation orientation ($B=0.04$, ns, in Model 3 of Table 3). Thus, although the unstandardized coefficient (B) drops slightly for internal sharing (comparing Model 1 to Model 4), taken together these results do not provide compelling evidence that innovation orientation mediates the relationship between internal sharing and innovation performance.

Insert Table 3 about here

Results according to Structural Equation Modeling

As an alternative approach to test the overall model, we also applied structural equation modeling to test the model shown in detail in Figure 3 (See Figure 3).

Insert Figure 3 about here

Note that the chi-square of the hypothesized model is 122.19, with 112 degrees of freedom, p-value is 0.24 which is not significant. Based on convention, (and perhaps counter-intuitively), a structural equation model is considered a good fit when the null hypothesis can be accepted (thus chi-square being non-significant as in the present case). Thus, the model is accepted as a good fit of the data. The other key statistical

measures of the hypothesized model support that there is good model fit (See Table 4). The CMIN/DF is 1.09, the GFI is 0.98, the CFI is 0.99 and the RMSEA is 0.01. We can thus conclude that the model is valid and proceed to interpret its results.

Indicators measuring each latent variable of this study are all significant at 0.001. It is confirmed that indicators load only on the constructs to which they belong. Path analysis shows that external acquisition ($B=0.40$, $p<0.001$) has a positive effect on innovation orientation but that internal sharing ($B=-0.51$, ns) has no significant effect. There is also no significant relationship between either knowledge management and innovation behavior. Innovation orientation positively contributes to innovation behavior ($B=0.33$, $p<0.001$). Our results show a significant mediating effect of innovation orientation in the relationship between external acquisition and innovation behavior while internal sharing is associated neither with innovation orientation nor innovation behavior (See Table 4).

Insert Table 4 about here

DISCUSSION

The aim of this study is to empirically investigate the relationship between knowledge management and innovation behavior, as well as the role of innovation orientation based on a random sample of 649 Dutch SMEs. Combining results from hierarchical regression analysis and SEM, our results most clearly support the conclusion that only external acquisition contributes positively to innovation behavior of a SME and does so indirectly by way of the mediating variable, innovation orientation. The results are most consistent with the conclusion that internal sharing, on the other hand, is associated neither with innovation orientation nor innovation behavior. These findings would appear consistent with other research views that external knowledge (but not necessarily internal sharing) is an essential determinant especially in new product innovation (Kazanjian *et al.*, 2001).

The full mediating role of innovation orientation in the relationship between external acquisition and innovation behavior is consistent with the predictions made in Hypothesis 2a. One interpretation of this result is as follows: SMEs having frequent external communication will get more information about the external environment. They

are more likely, in turn, to make better judgments and analyses regarding available information internal and external to the firm and thus more likely to perceive external opportunities in terms of new knowledge and new markets. Consequently, they will be more innovation-oriented and innovation-competitive than other firms. The dynamic capability approach argues that a firm's competitiveness depends on its dynamic capabilities, that is, its capacity of sense and shape opportunities and threats, the capacity to seize opportunities and the capacity of maintain competitiveness by renewing and developing existing tangible and intangible resources, and organizational capabilities (Teece, 2007).

Regarding the relationship between knowledge management and absorptive capacity, we began first with discussing the theoretical basis for assuming a relationship between knowledge management and absorptive capacity. From the existing literature on absorptive capacity (Cohen and Levinthal, 1990; Jansen *et al.*, 2005; Kim, 1998; Mowery and Oxley, 1995; Zahra and George, 2002), we find that those authors already implicitly address the relationship between knowledge management and development of absorptive capacity of a firm.

Limitations and Suggestions for Future Research

This study has some limitations. First of all is the lack of direct measurement of the concept of absorptive capacity. Although we theoretically argue that knowledge management can develop absorptive capacity which results in a better innovation behavior, we have not found a way to measure absorptive capacity directly. One possibility would be self reports of such a capability. But it is not clear whether such a self-report from a director would provide a reliable or valid measure of such a variable. We do question the way absorptive capacity has been previously measured, especially those simply measuring the capital allocated to research and development since capital itself is not a capability, *per se*.

In addition to the variables examined in this study, in future research prediction of innovation behavior could be strengthened by including a more complete set of knowledge management. Other independent variables might also include human capital, such as aptitude, creativity, knowledge, education and work experience, and social capital, that is, how well different individuals in the firm work together as a team. Certain context variables which might moderate relationships might also include certain

industry characteristics (e.g. capital intensity of the industry, or rate of change in technology), and ownership structure (such as whether the firm is owned by a single entrepreneur, group of unrelated owners, and/or family members). Other organizational factors such as strategy or organization structure could also be explored.

Another weakness in the present study is the fact that a single respondent was used to report information from each firm. It may be, especially for such indicators as internal sharing, that multiple respondents would give a different and perhaps more accurate picture of the situation in each firm. Another area to explore for future research is the examination of the model on a more longitudinal basis. Although there is a one-year lag between the independent and dependent variables, the dependent variable by its nature measures retrospective information from the previous year, thus not providing much time delay. Measurement of the dependent variable along several time periods could thus be conducted to provide a better understanding of the directions of cause and effect among the proposed relations.

CONCLUSION AND IMPLICATIONS

The primary purpose of this study was to identify the relationship between two aspects of knowledge management, including external acquisition and internal sharing, and innovation behavior, using a large random sample of 649 Dutch SMEs. In addition, innovation orientation was tested as a mediating variable in this relationship. The model was controlled for differences in firm size, age and sector. Empirical evidence from this study most clearly supports the conclusion that external acquisition has a positive indirect effect on innovation behavior, mediated by innovation orientation. Similar conclusions for internal sharing and innovation behavior are not supported by our data, especially when comparing results for both the regression analysis and SEM analysis.

The key finding of this study is the importance of external acquisition for SMEs. Empirical evidence shows that a disproportionate amount of innovation (including new patents and other inventions and discoveries) comes from small to medium-sized firms (SMEs) (Thompson and Leyden, 1983; Acs, 1996). Our study suggests that SMEs may innovate in different ways than large organizations. Instead of building new knowledge and creating innovation opportunity in-house, they often seek opportunities and acquire new external knowledge through social ties and communication with external resources. A favorable external communication system can make SMEs more innovative, perhaps by improving their ability to identify new opportunities from the external environment.

Therefore, policy makers who want to stimulate SMEs' innovation behavior may want to assess first the external environment in a certain region or in a nation. Policy makers should ask: Can SMEs access enough external resources, and is there a rich enough network (e.g. from the government, universities, research consortia, etc.), to which they can be connected?

Our study also indicates the importance of knowledge management in SMEs. Although a common feature of SMEs is the ease of communication within the firm (Desouza and Awazu, 2006), formalizing certain knowledge management as organizational routines may make the results more effective. Owners/entrepreneurs of SMEs may benefit from sending not only themselves but also certain employees to seminars and conferences. Engaging in formal and informal network building activities may also prove useful. Based on our result, it can be concluded that external knowledge may be more directly an influence on the firm's innovation strategy or intentions than on its innovation behavior, per se. Firms which actively acquire external knowledge (regardless of the type of knowledge) may build a greater competitive dynamic capability to sense and seize business opportunities which in turn may lead to new or improved products or processes. Therefore, by strategically managing knowledge management and especially external acquisition activities, owners/entrepreneurs of SMEs and their firms will benefit in the long term. The current research has its limitations. Nevertheless, given the limited number of large, random sample empirical studies of SMEs to date, the present study provides some useful guidelines for policy makers and entrepreneurs.

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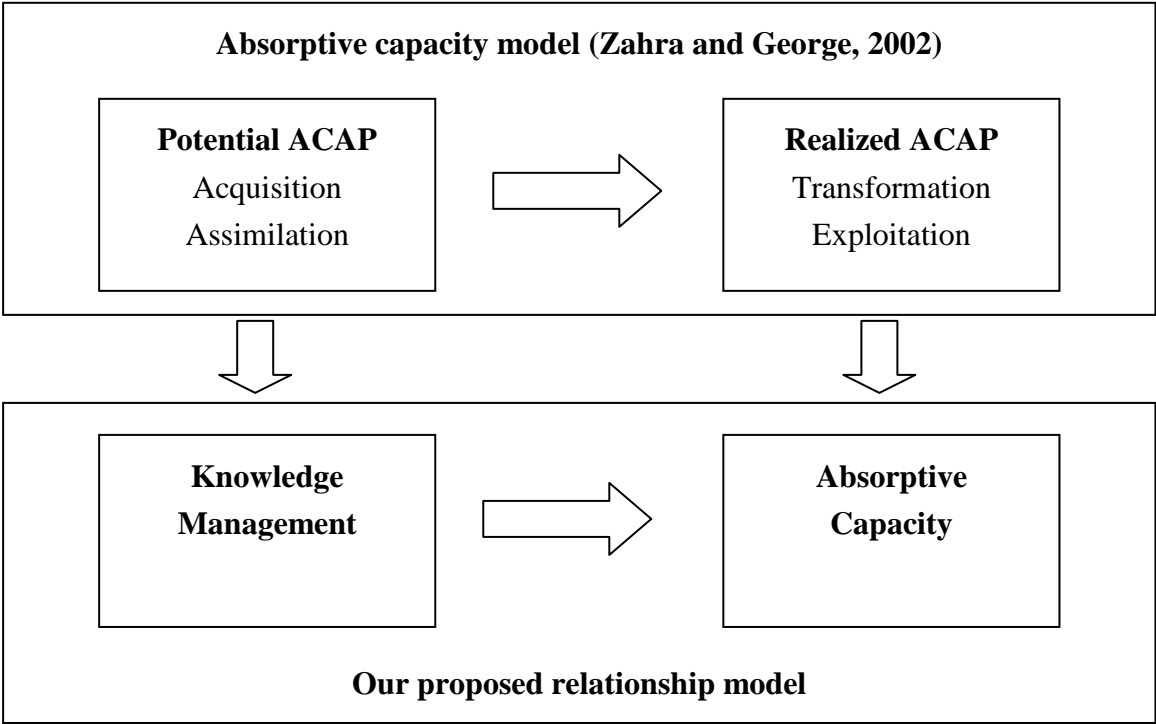
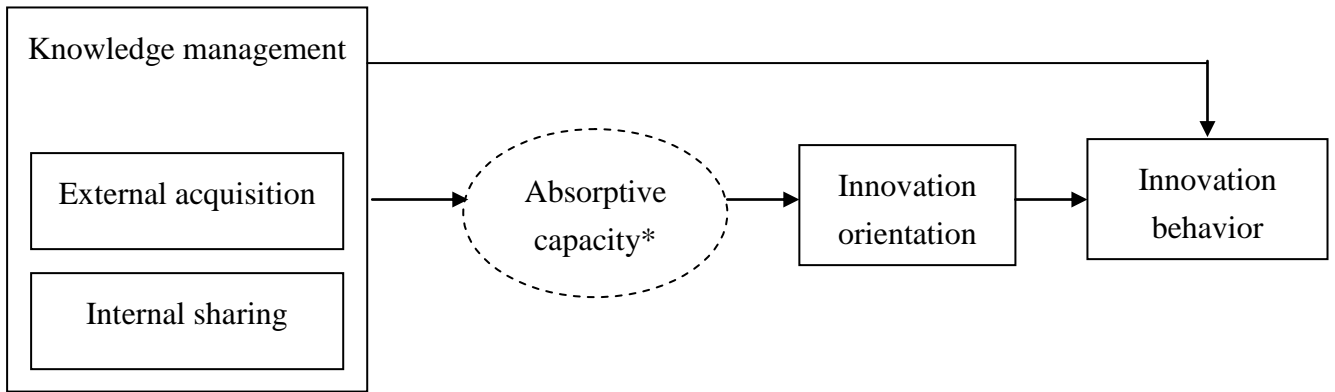
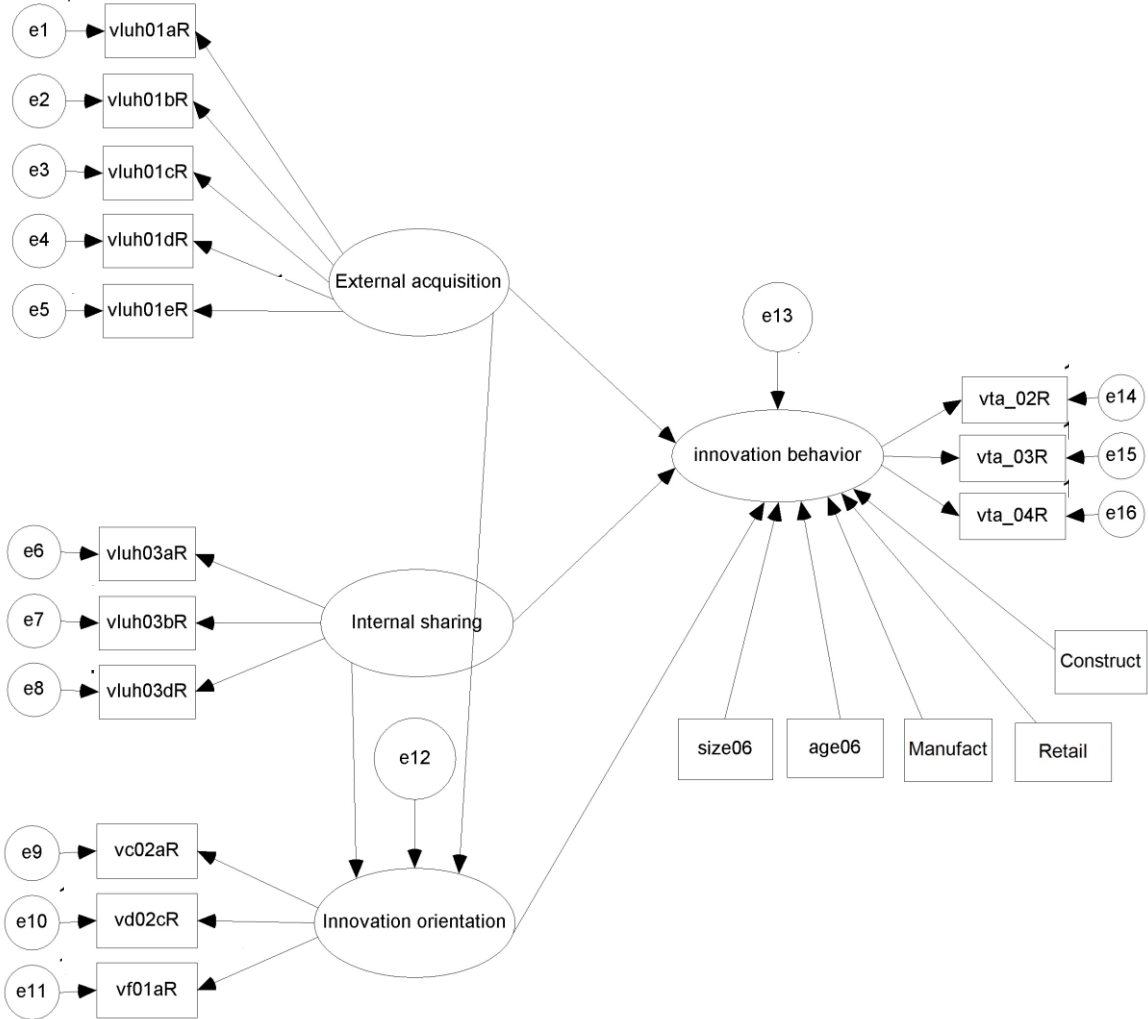


Figure 2. Proposed research framework



* *Absorptive capacity is an unmeasured intervening variable in this study.*

Figure 3. Predicted relationship in the Structure Equations Model



** The dependence between independent variables is taken into account while testing the structural equation model*

Table 1. Results of Common Method Bias Test for Knowledge Management, Innovation Orientation and Innovation behavior

		Component				
		1	2	3	4	
Knowledge Management	External Acquisition	Our company collaborates with other organizations (companies, universities, technical college) through alliances.	.69	-.04	.17	-.01
		The organization encourages employees to join formal or informal networks outside the organization	.67	.16	.16	.04
		Sending employees to exhibitions, congresses or seminars on a regular basis.	.72	.10	.11	.06
		Staying in touch with professionals and experts outside the company	.60	.16	.21	-.09
		To stay in touch with new developments, our company hires new employees with particular expertise.	.63	.15	-.11	.22
	Internal Sharing	Director (management) holds frequent meetings with employees to share recent discoveries and insights.	.14	.72	.12	.09
		The company has special procedures or other ways to guarantee the sharing of best practices among members of the organization.	.32	.57	.12	.06
		Employees share knowledge and experience by talking to each other.	.01	.79	-.01	-.02
	Innovation Orientation	Would you describe your strategy as renewing products, services or processes?	.12	.03	.75	.08
Within our company people are constantly thinking about new products or services that serve future needs		.11	.17	.73	.10	
Are you going to invest in new products or services in the next 12 months		.24	.00	.59	.27	
Innovation behavior	Has the company introduced products or services to the market in 2006, that were new to the market.	.07	.11	.41	.63	
	Has the company introduced products or services to the market in 2006, that were new to the company	.03	.03	-.03	.80	
	Has the company developed new products or services in 2006	.04	.02	.22	.72	
Cronbach's alpha		.80	.63	.62	.64	

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Table 2. Mean, standard deviation and Pearson correlations for all variables in the study (n=649)

	1	2	3	4	5	6	7	8	9
1. Innovation behavior	1.00								
2. Innovation orientation	0.41***	1.00							
3. External acquisition	0.18***	0.39***	1.00						
4. Internal sharing	0.08	0.07	0.10*	1.00					
5. size	0.09*	0.19***	0.29***	-0.11**	1.00				
6. age	-0.03	-0.01	0.05	-0.05	0.25***	1.00			
7. Manufacturing sector	0.23***	0.10*	-0.06	-0.04	0.08*	0.11**	1.00		
8. construction sector	-0.17***	-0.20***	-0.08*	-0.07	0.00	0.06	-0.18***	1.00	
9. Retail & wholesale sector	0.00	-0.05	-0.09*	-0.02	-0.20***	-0.06	-0.22***	-0.19***	1.00
Mean	0.00	0.00	0.00	0.00	2.58	27.95	0.17	0.14	0.19
Standard deviation	1.00	1.00	1.00	1.00	0.95	27.63	0.38	0.34	0.40

* $p < .05$; ** $p < .01$; *** $p < .001$, two tailed tests of significance.

Table 3. Regression Results and Mediated Effect (n=649)

Dependent variables	Innovation behavior		Innovation behavior		Innovation orientation		Innovation behavior	
	Model 1		Model 2		Model 3		Model 4	
explanatory variables	b-value	t-value	b-value	t-value	b-value	t-value	b-value	t-value
constant	-.20	-1.58	-.13	-1.12	-.18	-1.52	-.13	-1.13
Knowledge management								
External acquisition	.17**	4.36			.36**	9.59	.04	1.07
Internal Sharing	.07 [†]	1.76			.04	.98	.05	1.51
Innovation orientation			.38**	10.39			.36**	9.20
general context								
size	.06	1.42	.03	.75	.10*	2.30	.03	.67
age	-.002 [†]	.08	-.002	-1.38	-.002	-1.32	-.002	-1.39
Manufacture	.64**	6.09	.53**	5.35	.25*	2.43	.55**	5.54
construction	-.26*	-2.26	-.13	-1.18	-.42**	-3.84	-.11	-1.00
Retail/wholesale	.16	1.61	.15	1.55	-.01	-.07	.17 [†]	1.73
R-square	.11		.21		.20		.22	
Adjusted R-square	.10		.21		.19		.21	

[†] $P < .10$; * $p < .05$; ** $p < .01$

Table 4. Results of Direct, Indirect Effects and model of fit (n=649)

			Estimate	S.E.	C.R.
Innovation orientation	<---	External acquisition	.40***	.08	5.05
Innovation orientation	<---	Internal sharing	-.05	.18	-.28
Innovation behavior	<---	Innovation orientation	.33***	.05	6.27
Innovation behavior	<---	size06	.01	.01	.73
Innovation behavior	<---	age06	.00	.00	-.53
Innovation behavior	<---	Manufact	.17***	.04	4.82
Innovation behavior	<---	Construct	-.04	.03	-1.35
Innovation behavior	<---	Retail	.04	.03	1.22
Innovation behavior	<---	External acquisition	-.07 [†]	.04	-1.83
Innovation behavior	<---	Internal sharing	.13	.08	1.61
vluh01eR	<---	External acquisition	1.00		
vluh01dR	<---	External acquisition	.93***	.10	9.04
vluh01bR	<---	External acquisition	1.10***	.10	10.59
vluh01aR	<---	External acquisition	.92***	.10	8.93
vluh01cR	<---	External acquisition	1.12***	.10	10.76
vluh03dR	<---	Internal sharing	1.00		
vluh03bR	<---	Internal sharing	2.58***	.43	6.01
vluh03aR	<---	Internal sharing	1.64***	.25	6.69
vd02cR	<---	Innovation orientation	1.54***	.16	9.92
vc02aR	<---	Innovation orientation	.48***	.05	9.82
vf01aR	<---	Innovation orientation	1.00		
vta_02R	<---	Innovation behavior	1.00		
vta_04R	<---	Innovation behavior	1.56***	.17	9.23
vta_03R	<---	Innovation behavior	.83***	.10	8.79

Model fit summary: $\chi^2=122.19$, $df=122$, $p=0.24$

	CMIN/DF	GFI	CFI	RMSEA	AIC	BIC	CAIC
Hypothesized model	1.02	.98	.99	.01	278.19	627.28	705.28
Saturated model		1.00	1.00		380.00	1230.33	1420.33
Independence model	11.81	.65	.00	.13	2056.69	2141.72	2160.72

[†] $P < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

APPENDIX A

Description of Variables

Variable	Description of Variable
<i>Knowledge management</i>	
External acquisition $\alpha = .80$	<p>The external acquisition construct was created using CATPCA, using the following five questions:</p> <ol style="list-style-type: none"> 1. Our company collaborates with other organizations (companies, universities, technical college) through alliances. 2. The organization encourages employees to join formal or informal networks outside the organization 3. Sending employees to exhibitions, congresses or seminars on a regular basis. 4. Staying in touch with professionals and experts outside the company 5. To stay in touch with new developments, our company hires new employees with particular expertise. <p>The items were answered with the following scale: (1='not at all applicable'; 2='not all that (barely) applicable'; 3='somewhat applicable'; 4='applicable to a great degree'; 5='totally applicable')</p>
Internal Sharing $\alpha = .63$	<p>The internal sharing construct was created using CATPCA, using the following three questions:</p> <ol style="list-style-type: none"> 1. Manager consults employees frequently to discuss new developments. 2. The company has special procedures or other ways to guarantee the sharing of best practices among members of the organization. 3. Employees share knowledge and experience by talking to each other. <p>The items were answered with the following scale: (1='not at all applicable'; 2='not all that (barely) applicable'; 3='somewhat applicable'; 4='applicable to a great degree'; 5='totally applicable')</p>
<i>Innovation Orientation</i>	
Innovation orientation $\alpha = .62$	<p>The innovation orientation construct was created using CATPCA, using the following three questions:</p> <ol style="list-style-type: none"> 1. Would you describe your strategy as renewing products, services or processes? (1='no'; 2='yes')

2. Within our company people are constantly thinking about new products or services that serve future needs

The items were answered with the following scale: (1='not at all applicable'; 2='not all that (barely) applicable'; 3='somewhat applicable'; 4='applicable to a great degree'; 5='totally applicable')

3. Are you going to invest in new products or services in the next 12 months?

(1='no'; 2='probably'; 3='certainly')

Innovation behavior

Innovation
behavior
 $\alpha=.64$

This scale was created by combining answers to the following three questions using the CATPCA technique:

1. Has the company introduced products or services to the market in 2006, that were new to the market?

2. Has the company introduced products or services to the market in 2006, that were new to the company?

3. Has the company developed new products or services in 2006?

(1='no'; 2='yes')

Control variables

size

Computed as the natural logarithm of the response to the following question. How many persons does the company employ?

age

Computed as the difference between founding year and 2006.

manufacturing
sector

Is the company operating in the industrial sector? (1='yes'; 0='no')

construction
sector

Is the company operating in the construction sector? (1='yes'; 0='no')

retail and
whole sale
sector

Is the company operating in sales or repair of consumer products? (1='yes'; 0='no')

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