

# Knowledge Management and the Effectiveness of Innovation Outcomes: The Role of Cultural Barriers

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**Abstract:** In this paper we propose a conceptual model to test the moderating effect of cultural barriers on the link between knowledge strategies and innovation using healthcare organizations. In order to study the tie (knowledge-innovation) and the effects of the moderating variable (cultural barriers), the resource-based view is followed. It has been generally accepted that both explicit and tacit knowledge play a basic role in organizational innovation. However, there are few research works that study the relationship between knowledge management strategy and the effectiveness of the innovation process. On the other hand, the extant research on this relationship has yielded inconclusive results. Our paper revisits this research topic based on data of knowledge management strategy, Knowledge base, cultural barriers and innovation outcomes from a sample of Spanish hospitals.

**Keywords:** knowledge base, innovation outcome, cultural barriers, healthcare organizations

## 1. Introduction

The healthcare industry sits on the hinge of a future in which doctors can instantly share imaging and test results with colleagues in the same building or across the city, country or continent. Patients should have access to their own medical history and be able to transfer it from one healthcare centre to another. Nowadays, innovation is a core competency of all healthcare institutions (Lansisalmi, et al., 2006). Furthermore, new information technology and genetic reengineering are radically changing health care companies, creating new opportunities for innovation and for the enhancement of the productivity of the actual processes (Govindarajan, 2007). Innovation in healthcare continues to be a driving force in the quest to balance cost cuts and health care quality. Consequently, innovation has become a key piece for the achievement of a sustainable competitive advantage.

It has also been generally accepted that both the explicit and tacit components of organizational knowledge play an important role in innovation (Hall and Andriani, 2003). With the emergence of knowledge management (KM) as a new discipline, connecting knowledge management and innovation has become a necessity.

However, there are few studies that address the relationship between KM and innovation. For instance, Johannessen et al. (1999) argued, at a theoretical level, that a high degree of innovation presupposes organizational learning systems, which develop, integrate and use knowledge in the practical context. Hall and Andriani (2003) studied managing knowledge associated with interorganizational innovation, and identified knowledge gaps in innovative firms. In another way, Jang et al. (2002), in their study of process innovation at the Samsung Company, described the relationship between the knowledge produced during process innovation activities and the organizational knowledge management. All these studies have provided abundant information on the relationship between knowledge management concepts and innovative concepts. They have nevertheless failed to explain the impact of this relationship on the performance and success of the innovation process.

Despite its importance, little or no research exists about how hospitals' cultural barriers may affect the relationship between knowledge management and innovation outcomes, and little is known about how cultural barriers influences the deployment of a firm's existing knowledge base and thereby facilitates

innovation. Moreover, an investigation of the role of organizational culture may refine our conceptual understanding of the knowledge-innovation link.

On the other hand, innovation reshapes the competitive landscape and creates new market opportunities. Various approaches have been proposed to identify its drivers (Smith and Thushman, 2005), among which the knowledge-based view (KBV) has gained importance (Zhou and Li, 2012). The principal assumption of KBV is that new product creativity is a function of the firm's ability to manage, maintain, and create knowledge. Most recently, Zhou and Wu (2010) asserted that a firm's existing knowledge base, namely, its knowledge breadth and depth, represent its main resource for innovation development.

Although business scholars have dedicated considerable effort to understanding the knowledge-innovation outcomes relationship, the existing literature offers conflicting empirical findings about the innovation outcomes implications of the knowledge base. It even suggests that the research examining the knowledge-innovation link has overlooked potential moderating variables. This study, in addition, investigates cultural barriers as a moderator in the knowledge base-innovation outcomes relationship.

To this end, the objectives of this work are to develop a model that: (i) examines the link between the knowledge resources (tacit-explicit, internal-external), the knowledge base, and the innovation outcomes and (ii) investigates the moderating role of the culture in the knowledge base-innovation outcomes link.

## **2. Theoretical background**

### **2.1 The knowledge-based view of the KM and innovation outcomes**

The essence of knowledge management (KM) with respect to innovation is that it provides a framework for management in their attempt to develop and enhance their organizational capability to innovate. Cohen and Levinthal (1990) label this as absorptive capacity. It defines the ability of an organization to recognize the value of new external information and knowledge, assimilate, and apply them, and this ability is critical in determining an innovative result. Extending this idea, Fiol (1996) argued that the potential of organizations to generate innovation outcomes is dependent on the previous accumulation of knowledge that they have absorbed.

According to the KBV, a firm's existing "knowledge base" set up its scope and ability to understand and apply new knowledge to decision-making, problem solving or innovations (Ahuja and Katila, 2001). Knowledge breadth and depth are two distinct dimensions of a knowledge base that reveal both the structure and content of the knowledge a firm holds. Knowledge breadth refers to the extent to which the firm's knowledge repository contains distinct and multiple domains. Knowledge depth refers to the level of sophistication and complexity of knowledge in key fields (Bierly and Chakrabarti, 1996). "The breadth attribute captures the horizontal dimension of knowledge and heterogeneous knowledge content, whereas the depth attribute reflects a vertical dimension and unique, complex, within-field knowledge content" (Zhou and Li, 2012).

### **2.2 Cultural perspective of knowledge management and innovation**

Literature on knowledge management and organizational innovation emphasizes the importance of culture as a major determinant in innovation outcomes (Feldman, 1988; Deshpande et al., 1993). In creating a supportive organizational environment for innovation, several practices relating to cultural barriers have been identified in the literature.

As innovation is essentially about converting ideas into something profitable, encouragement to supply ideas needs to be substantial in order to channel the creative ability of the employees to convert ideas into innovations. Therefore, organizations need to facilitate innovation by creating and maintaining an environment that supports idea generation and creativity. Such enabling conditions include the provision of resources and opportunities as well as minimizing constraints that could impede individual creativity (Amabile et al., 1996; Glynn, 1996).

According to Barney (1986) and several other researchers (Deshpande et al., 1993), a firm's culture, defined as a complex set of values, beliefs, assumptions, and symbols that define the way in which a

firm conducts its business (Barney, 1986, p. 657), can be a source of sustained competitive advantage, so it constitutes a strategic resource. Several innovation models suppose that organizational culture functions as a transforming element to ensure system survival and its ability to assimilate technologies and innovations. This may be achieved by fostering cultural norms that emphasize flexibility to change, open-mindedness, and openness in communication. In contrast, organizations that are less successful in fostering these cultural norms are less able to change themselves or evolve with their environments.

### 3. Research model and hypotheses

The following pages describe the key constructs included in the research model (Figure 1). On the basis of our literature review, we propose that knowledge management and organizational learning play different roles in contributing to innovation. Using the knowledge-based perspective, we propose that knowledge management strategies' antecedents pertaining to the KM focus (tacit-explicit) and KM source (internal-external) precede the knowledge base and that the knowledge base is connected with innovation outcomes. We further propose, from the culture-based perspective, that an organization's culture – or several cultural barriers- influences the relationship between the knowledge base and innovation outcomes. The central theme of our proposed model, therefore, is that understanding the relationship between the knowledge base, its antecedents, its consequences, and cultural barriers can lead to a better understanding of the relationship between knowledge management and firm innovation.

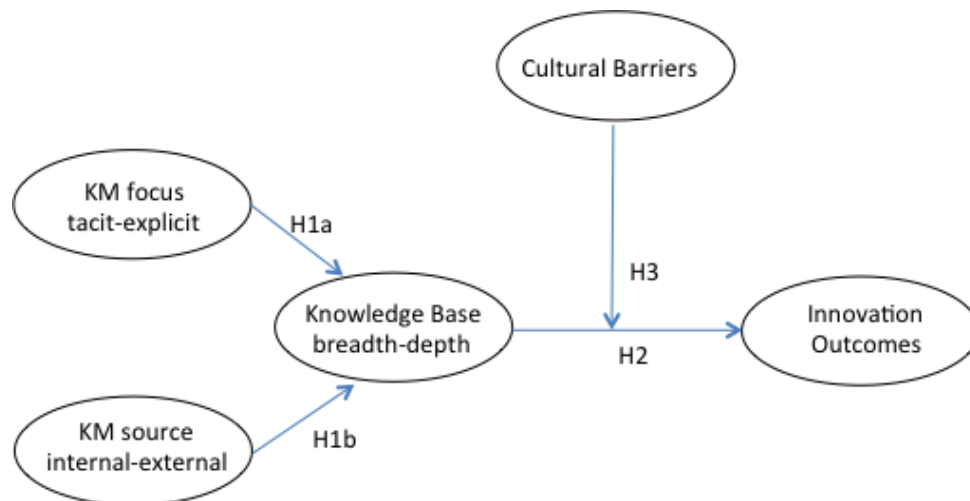


Figure 1: Research model and hypotheses

#### 3.1 Antecedents of the knowledge base: KM strategies

KBV theory suggests that knowledge is an essential strategic resource for a firm to retain sustainable competitive advantage. As knowledge is created and disseminated throughout the firm, it has the potential to contribute to the firm's value by enhancing its capability to respond to new and unusual situations. The growing importance of knowledge as a critical resource has encouraged managers to pay greater attention to the firm's KM strategies. A growing body of KM studies has examined the range of KM strategies and attempted to classify them. Syntheses of this research suggest that KM strategies can be primarily categorized based on two key dimensions: the KM focus and the KM source. In the KM focus dimension, KM strategies can be categorized as explicit-oriented and tacit-oriented. Explicit-oriented strategy attempts to increase organizational efficiencies by codifying and reusing knowledge mainly through advanced information technologies. Tacit-oriented strategy takes on the personalization approach where tacit knowledge is communicated through direct person-to-person contact and through socialization processes. The second dimension to orient to KM strategy is based on the firm's primary source knowledge. KM strategies can be differentiated as internal-oriented and external-oriented along this dimension. External-oriented strategy attempts to bring knowledge from outside sources via either acquisition or imitation and then transfer that knowledge throughout the organization. Internal-oriented strategy focuses on generating and sharing knowledge within the boundary of the firm (Choi et al., 2008, 236).

Several studies suggest a complementary relationship between KM strategies. The central proposition is that adopting a full set of KM strategies is related to high performance while the adoption of individual KM strategies results in little or insignificant performance gain. These studies showed that a complementary set of explicit-tacit, even tacit-internal oriented plus explicit-external oriented strategies resulted in higher performance (Choi and Lee, 2003). This complementary set of KM strategies leads to the existence of synergies and expands the firm's knowledge base and the innovation outcomes. By applying this rationale, we hypothesize that:

*H<sub>1a</sub>: The Tacit-Explicit oriented strategy (KM focus) positively affects the knowledge base.*

*H<sub>1b</sub>: The Internal-External oriented strategy (KM source) positively affects the knowledge base.*

### **3.2 Consequence of the knowledge base: Innovation outcomes**

Research on organizational knowledge has identified several dimensions along which organizational knowledge bases can be differentiated and has examined the implications of these dimensions for knowledge-related outcomes. The size of a knowledge base has been related to the organization's innovative productivity (Ahuja and Katila, 2001). Similarly, the degree of overlap between different organizational knowledge bases has been related to the ability of an organization to absorb external knowledge from its geographic or technological neighbors (Lane and Lubatkin, 1998). But although prior research has focused on the number of elements in a knowledge base (its size) or the identities of those elements as compared with the knowledge bases outside the organization (its relatedness), it has not considered how the structure by which different knowledge elements are coupled together or isolated from each other in different clusters will affect the organization's ability to combine knowledge elements for innovation.

Highly useful innovations often emerge from the interplay between deep knowledge born from specialization and variety generated through broad exploration (Katila and Ahuja, 2002), and integrative mechanisms that connect the two. Specialization fosters a deep understanding of a specific area, ease of use arising from the repeated application of a few elements, and a superior knowledge of the interconnections between a set of elements, as well as of the problems in connecting the elements to each other (Katila and Ahuja, 2002). Broad exploration provides exposure to new ideas, innovative applications, and distinctive new variations and combinations of a given set of elements (Katila and Ahuja, 2002). Integrative mechanisms ensure that the deep knowledge acquired through specialization is matched with the novel applications identified through a broad search. To explain the generation of useful inventions, it then becomes relevant to understand how different knowledge-based structures, from non-decomposable (or integrated) to nearly decomposable and to fully decomposable (or modular), can provide all three components of this mix: search breadth, deep knowledge, and integrative mechanisms. These allow the search breadth to be combined effectively with deep knowledge (Yayavaram and Ahuja, 2008, 339). Prior research suggests that in the search process that underlies recombinant inventions, maintaining a balance between depth and breadth is critical to successful invention (Prajogo and Ahmed, 2006). The size and structure of an organization's knowledge base can determine how well it manages knowledge resources and creates innovation capacity (Yayavaram and Ahuja, 2008, 333). Such tacit-explicit and external-internal knowledge integration is likely to affect how firms fully utilize the potential of their knowledge bases and create innovations. By applying this rationale, we hypothesize that

*H<sub>2</sub>: The breadth and depth knowledge base positively affects innovation outcomes*

### **3.3 The moderating effects of cultural barriers**

Culture is defined as the shared values, beliefs, and practices of the people in the organization (Schein, 1985). Culture is reflected not only in the visible aspects of the organization, such as its mission and espoused values, but also in the way people act, what they expect of each other and how they make sense of each other's actions (McDermott and O'Dell, 2001). Although culture is a conglomeration of essential organizational elements that serve as a foundation and nurturer (Senge, 1990), an innovative project for managing knowledge requires changes in corporate culture (Bures, 2003). Because the environment is constantly changing, we argue that an individual's knowledge developed by guiding the firm through its culture is likely to be time-bound and may lose its relevance and value over time (de Holan and Phillips, 2004; Becker, 2008). In this respect, the potential negative impacts of the mental models used (in terms of biases in recall, belief systems, and blind

spots) for decision-making have been discussed by several authors. Chapman and Ferfolja (2001), for instance, find that mental models are simplified abstractions of the experienced world and, as such, are always incomplete. In this regard, Akgün et al. (2006) argue that an urgent change in customer needs may initially lead design engineers to deny these changes are really needed and to refuse to alter original plans so as to avoid the additional stress. This means that for organizational innovation to occur on an organizational level, there are some cultural barriers companies must overcome to ensure that organizational members have adequate knowledge and experience to perform their responsibilities. Cultural barriers can have a number of causes, for example a lack of training or instruction, lack of motivation, lack of basic ability, or some underlying problems (Grugulis and Bevitt, 2006). Regarding this, many training programs have focused attention on teaching organizational members to overcome cultural barriers (McDermott and O'Dell, 2001). For example, learning more about barriers to assuming new behavior patterns is a strategy to judge the adequacy of assumptions and opinions among individuals (Sinkula, 2002). Another critical factor determining a changing company's success is its members' motivation to actively participate in community knowledge generation and sharing activities (Ardichvili et al., 2003). As Sinkula (2002) points out, individuals on the company that lack motivation to implement new behavior patterns can lead to complacency with the current view of "how the world works," that can also lead to overestimate their understanding of the situation (Becker, 2008). Applying the implications of these barriers to organizational networks, arguably, shared codes, and languages will foster similar worldviews, opinions, and attitudes within a company's network, which in turn affect the potential effect of knowledge base on organizational innovation (Sinkula, 2002).

Many studies have demonstrated the positive effect of organizational culture on organizational innovation (Deshpande et al., 1993; Hernández-Mogollón et al., 2010). A truly innovative firm must be embedded in a strong culture that stimulates engagement in innovative behavior (Santos-Vijande and Alvarez-Gonzalez, 2007). The basic assumption is that culture plays a key role in enabling companies to achieve speed and flexibility in the innovation process. Past research also suggests that companies must possess adequate organizational resources and skills (like organizational culture) to successfully develop new products (Calantone et al., 1993). With this in mind, we suggest that adequate culture injects new ideas into the organization, increases the capacity to understand new ideas and strengthens creativity and the ability to spot new opportunities that favor organizational innovation.

However, although it seems clear that knowledge base can help organizational innovation; cultural barriers can condition this relationship. Cultural barriers have been variously described as "deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action" (Senge, 1990); "the personal biases and assumptions we use to make decisions that drive our behaviour" (Birkner and Birkner, 1998); and "the context in which to view and interpret new material" (Kim, 1993). These considerations lead us to argue that cultural barriers can cause emotional states of confusion, helplessness, and intense anxiety, as well as hindering the innovation process, as members of an organization are not yet familiar with the relevant new facts and are unable to foresee the consequences of their actions (McDermott and O'Dell, 2001; Sinkula, 2002; Bures, 2003). Therefore, before fostering knowledge base in their organizations managers have to consider some cultural barriers in knowledge sharing such as: structure of the organization; employees' behavior towards change; and benefits after change (Thomke and Reinertsen, 1998; Keskin, 2006). Otherwise, based on the wrong perceptions, preconceptions and stereotypes that have been created through those barriers, we would expect a littler influence of knowledge base on organizational innovation. These considerations lead us to propose the H3 of the work:

*H<sub>3</sub>: The extent to an organization has cultural barriers will determine the extent to which knowledge base supports innovation outcomes.*

## 4. Methodology

### 4.1 Sample

We drew our sample from a mailing list of the National Catalogue of Hospitals in Spain (<http://www.hospitalandia.com/>). We identified 993 hospitals in Spain (both public and private) who met our selection criteria. Informants who did not reply to the initial survey within 3 weeks were identified and a second set of survey materials was mailed to them. The two mailing efforts yielded

139 usable surveys returned (14% response rate). However, the low response rate for this sample is not a serious concern because we examined the generalizability with two different nonresponse bias tests. We assessed potential nonresponse bias through a series of *t*-tests that compared early (responses to the initial mailing) with late (responses to the follow-up mailing) respondents in terms of all key constructs. The results suggest that there is no significant difference between early and late respondents in the key variables. In addition, we compared non-responding firms with responding firms in terms of their demographics. These results also suggest that there are no significant differences between respondent and non-respondent firms.

## 4.2 Measures and validity

The questionnaire consisted of a number of relevant items and the responses were on a seven-point Likert scale ranging from “very low” to “very high”. All questionnaires and scales used were adapted to hospitals. Research constructs were operationalized on the basis of related studies and a pilot tests. All of the research constructs have already been validated and used for other studies on knowledge management and innovation. Thus, items for assessing the *KM focus (explicit-tacit-oriented)* have already been validated and used by Choi and Lee (2003). Questionnaire items for the *KM source (external-internal-oriented)* which were used in this study had been validated and used by Lee *et al.* (1999). To measure the *knowledge base (breadth and depth)*, the construct by Zhou and Li (2012) was adopted. The “culture barriers” scale was constructed from a literature review and an expert panel; identifying thus, the proper items of this construct. Four items composed the final separate scale for “culture barriers.” Previous studies by McDermott and O’Dell (2001) and Bures (2003) provide guidance in developing items to measure culture barriers. Among the indicators of cultural barriers factors relating to the existence of conflict among individual motives to share knowledge (e.g. lack of motivation and resistance to change) are most often used (Bures, 2003). We also adopted questions focusing on policies, rules, reporting structures, and decision-making protocols that often prevent effective knowledge sharing (McDermott and O’Dell, 2001). This scale is measured in reverse, the highest score to the lowest degree of cultural barriers. As for innovation outcomes, instead of the traditional single dimensional measures, we adopted the eight items from Prajogo and Ahmed (2006). Following the argument by these authors, we deemed it more appropriate to operationalize innovation outcomes as a construct for measuring both product and process innovation. With respect to the measurement approach, perceptual data in which the respondents were asked to evaluate the hospital's innovation outcomes in comparison to the major competitor in the industry were used in order to minimize industry effects. We also controlled for several variables. First, we measure *hospital size* by the number of hospital beds to control for the greater complexity and economies of scale that occur in large hospitals. Second, we measure *technology uncertainty* (adapted from Atuahene-Gima and Murray, 2004) using four items that pertain to the unpredictability of changes in technology and the rate of product introductions. Third, to reflect the speed of change in customer demand and competitor actions, we measure *market uncertainty* with five items (adapted from Atuahene-Gima and Murray, 2004). Table 1 presents the confirmatory factor analysis results for these measures.

**Table 1:** Confirmatory factor analysis results measure

Measures	Cronbach’s α	Composite reliability	Average variance extracted
KM focus	0.7230	0.6231	0.5207
KM source	0.7880	0.7110	0.6979
K base	0.7021	0.7114	0.5100
Innovation outcomes	0.7790	0.8264	0.7855
Cultural barriers	0.7723	0.6967	0.6733
Technology uncertainty	0.8080	0.7522	0.7169
Market uncertainty	0.8112	0.7960	0.7458

## 5. Results

### 5.1 Model specification

We specify the model as follows:

$$(1) \text{KBASE} = \beta_0 + \beta_1 (\text{KMFOCUS}) + \beta_2 (\text{KMSOURCE}) + \beta_3 (\text{CON}_{1-3}) + \varepsilon_1, \text{ and}$$

$$(2) \text{ INNOVAT} = \beta_0 + \beta_1(\text{KMFOCUS}) + \beta_2(\text{KMSOURCE}) + \beta_3(\text{KBASE}) + \beta_4(\text{CB}) + \beta_5(\text{KBASE}) \times (\text{CB}) + \beta_6(\text{CON}_{1-3}) + \varepsilon_2$$

Where KBASE is the knowledge base; KMFOCUS the knowledge management focus (explicit-tacit); KMSOURCE the knowledge management source (external-internal); CB the cultural barriers; INNOVAT the innovation outcomes; CON<sub>1</sub> the control variable, hospital size; CON<sub>2</sub> the control variable, technology uncertainty; and CON<sub>3</sub> the control variable, market uncertainty.

To test for common method variance in the survey, we used the Harman one-factor method. If common method bias were a serious problem, either a single factor would emerge or a general factor would account for most of the variance in the data. Because our principal component factor analysis of the data yielded five factors, each with an eigenvalue greater than 1.0, we conclude that common method bias is not a problem in this empirical study. We first assess the measurement model using confirmatory factor analysis (CFA)/LISREL, and then test the hypotheses using two-step regression analyses. In the regression analyses, we first regressed the knowledge base on antecedent variables (i.e., the KM focus, the KM source), controlling for hospital size, technology uncertainty, and market uncertainty, to test  $H_{1a}$  and  $H_{1b}$ . Then we regressed innovation outcomes simultaneously on the antecedent variables, the knowledge base, and the moderator variable (i.e., cultural barriers), controlling for hospital size, technology uncertainty, and market uncertainty. In this equation, we also introduced the interaction terms into the analysis (to accommodate the interaction of the knowledge base with the moderating variable) to test  $H_2$  and  $H_3$ . As a brief summary of the results, we show the zero-order correlation matrix for the five latent variables and provide an overview of their interrelationships in Table 2. Because all correlation coefficients are less than 0.50, multicollinearity does not appear to be a problem.

**Table 2:** Correlation matrix and descriptive statistics

Latent constructs	1	2	3	4	5	6	7	8		
1 KM focus	0.513 <sup>a</sup>									
2 KM source	0.47 <sup>b</sup>	0.687 <sup>a</sup>								
3 K base	0.35 <sup>b</sup>	0.26 <sup>b</sup>	0.516 <sup>a</sup>							
4 Innovation outcomes	0.09 <sup>b</sup>	0.117 <sup>b</sup>	0.45 <sup>b</sup>	0.793 <sup>a</sup>						
5 Cultural barriers	0.06 <sup>b</sup>	0.07 <sup>b</sup>	0.13 <sup>b</sup>	0.35 <sup>b</sup>	0.612 <sup>a</sup>					
6 Hospital Size	-0.06 <sup>b</sup>	0.28 <sup>b</sup>	0.03 <sup>b</sup>	0.18 <sup>b</sup>	0.14 <sup>b</sup>	N.A.				
7 Technology uncertainty	-0.07 <sup>b</sup>	-0.08 <sup>b</sup>	-0.05 <sup>b</sup>	0.08 <sup>b</sup>	0.03 <sup>b</sup>	0.07 <sup>b</sup>	0.612 <sup>a</sup>			
8 Market uncertainty	0.08 <sup>b</sup>	0.03 <sup>b</sup>	0.18 <sup>b</sup>	0.09 <sup>b</sup>	0.05 <sup>b</sup>	0.05 <sup>b</sup>	0.07 <sup>b</sup>	0.724 <sup>a</sup>		
Notes: Sample size: n=139. N.A.= Not Available										
<sup>a</sup> Figures on the diagonal are square roots of average variance extracted (AVE)										
<sup>b</sup> Significant at $\alpha=5\%$										

## 5.2 Confirmatory factor analysis

We used CFA to verify the measurement model and obtained maximum likelihood estimates with LISREL 8.30, using the covariance matrix as its input.

Although the  $X^2$  value, which indicates the extent to which the specified model can reproduce the pattern of observed variances and covariances among the variables under investigation, is statistically significant, the ratio of  $X^2$  to degrees of freedom (df) is less than 3 ( $X^2/\text{df} = 2.06$ ). This indicates that the data fit the hypothesized model well. Furthermore, many researchers emphasize the need to relax the interpretation of  $X^2$  statistics, particularly when the sample size is small. Most recent structural equation modeling studies use the ratio of  $X^2$  to df as the preferred fit index.

Table 1 shows that the Cronbach's  $\alpha$  statistics for the constructs range from 0.7021 for knowledge base to 0.8112 for market uncertainty, which suggests that the scales are sufficiently reliable. Some critics argue that Cronbach's  $\alpha$  -as a basic statistic to test the reliability of a measure according to its internal consistency- does not adequately estimate errors caused by factors external to an instrument, such as differences in testing situations and respondents over time. In the structural equation modeling context, composite reliability and average variance extracted (AVE) have been suggested as alternatives because they are more parsimonious than Cronbach's  $\alpha$ . Thus, in Table 1, we also provide the composite reliability indices, which range from 0.6231 to 0.8264, in excess of the required value of 0.60. Furthermore, all AVE exceed the threshold level of 0.50. Taken together, these

statistics suggest that all constructs are sufficiently reliable. We also tested the measurement models for convergent validity (i.e., the degree of association between measures of a construct), discriminant validity (i.e., the degree to which measures of constructs are distinct), and the nomological validity (i.e., validity of the entire model). In the CFA, each measure loaded significantly on the expected constructs. This demonstrates convergent validity. As we also show in Table 1, the seven constructs exhibit excellent convergent validity, because their AVE is greater than 0.50. Table 2 reveals that the diagonal elements, which represent the square roots of the AVE for each of the constructs, are greater than the off-diagonal elements. This also satisfies the criterion of discriminant validity. Overall, the measurement model is acceptable for reproducing the population covariance matrices.

### 5.3 Hypotheses testing results

As Hair *et al.* (1998) recommend, we mean-centered the variables before we created the interaction terms to minimize the effect of multicollinearity. In Table 3, Models 1 and 2 uses the knowledge base as the dependent variable, and Models 3–5 pertain to innovation outcomes. We use Model 1 to test the effects of the control variables on the knowledge base, and then add the main effects of the antecedent variables (the KM focus and the KM source) in Model 2. This contributes 28% more variance explained than the control variables.  $H_{1a}$ , which predicted that KM focus (explicit-tacit) would be positively related to knowledge base, is therefore supported ( $\beta=0.21, p=0.016$ ). In addition, the KM source (external-internal) is positively related to the knowledge base, supporting  $H_{1b}$  ( $\beta = 0.24, p = 0.004$ ). In Model 3, we introduce the main effects of the control variables on innovation outcomes, including the KM focus and the KM source, because previous knowledge-based view studies suggest that these variables can influence innovation performance. With Model 4, we add the main effects of the knowledge base and the moderating variable (cultural barriers). These contribute 6% more variance explained than that offered by the control variables. Thus, consistent with  $H_2$ , the knowledge base positively affects innovation outcomes. Finally, Model 5 includes the interaction term. For testing moderated relationships, we find that the changes in  $R^2$  are significant when we add the cultural barriers and knowledge base interaction terms. These variables increase the explained variance by 17% more than that obtained with Model 4. Next, we check the interaction items to test  $H_3$ , which states that low cultural barriers strengthen the knowledge–innovation link. Results from Model 5 show that the knowledge base has a more positive effect on innovation when cultural barriers are lower ( $\beta = 0.27, p = 0.001$ ), supporting  $H_3$ .

**Table 3:** Results of regression analysis

		Knowledge base (DV)		Innovation outcomes (DV)		
		Model 1	Model 2	Model 3	Model 4	Model 5
<i>Controls</i>						
Hospital size		0.03	0.02	0.07	0.09	0.09
Technology uncertainty		-0.04	-0.07	-0.08	-0.16	-0.07
Market uncertainty		0.05	0.01	0.10	0.06	0.17
<i>Direct effects</i>						
KM focus	$H_{1a}$		0.21*	0.17*	0.09	0.05
KM source	$H_{1b}$		0.24*	0.13	0.08	0.07
Cultural barriers					0.23*	0.20*
Knowledge base	$H_2$				0.25*	0.21*
<i>Interaction effects</i>						
Knowledge base x cultural barriers	$H_3$					0.27*
<i>F-value</i>						
		0.10	17.21*	9.25*	12.76*	11.82*
<i>R<sup>2</sup></i>						
		0.01	0.27	0.27	0.24	0.36
<i>Adjusted R<sup>2</sup></i>						
		0.00	0.25	0.18	0.29	0.23
<i>ΔR<sup>2</sup></i>						
			0.28		0.07	0.17
<i>Notes:</i>						
Mean-centered variables were used to minimize the effect of multicollinearity.						



DV: dependent variable.
Standardized regression coefficients are shown.
* $p < 0.05$ , one-tailed tests.

## 6. Conclusions

This study simultaneously examines (i) the antecedents of the knowledge base and (ii) the contingent relationship between the knowledge base and innovation outcomes by introducing the cultural barriers as a moderator. Specifically, we treat knowledge management strategies as antecedents of the knowledge base, view the innovation outcomes as a consequence of the knowledge base, and investigate the moderating role of the culture. Our results, based on a sample of Spanish hospitals, confirm that knowledge management strategies (explicit-tacit oriented and external-internal oriented) precede the knowledge base. This is consistent with previous empirical findings in the knowledge management literature (Choi and Lee, 2003; Choi *et al.*, 2008). Our results also demonstrate that cultural barriers moderate the knowledge–innovation link. Our extension of the extant research also indicates that the innovations advantages of the knowledge base are contingent on several culture aspects such as the existence of conflict among individual, lack of motivation and resistance to change. This study reflects the central importance of acquiring and using knowledge in a culture that encourages knowledge sharing. This study offers further support for the idea that hospitals should be treated as knowledge-based entities. Moreover, our research suggests that cultural barriers has a strong impact on the knowledge–innovation link, in such a way that the knowledge base pays off better for those hospitals which have low barriers to creativity and knowledge sharing among people. In other words, the link between the knowledge base and innovation outcomes is strengthened when hospitals reduces barriers to knowledge transfer and create open cultures.

Research suggests that cultural barriers tend to promote learning as a means of exploitation, to promote the achievement of specific organizational goals, thereby promoting compliance rather than creativity (March, 1991; Levit and March, 1988). As we have indicated, failure to remove such cultural barriers is likely to block the collective appropriation of new knowledge and the recognition and exploration of future opportunities (Levinthal and March, 1993). We therefore argue that it is important for organizations to provide an appropriate environment for overcoming cultural barriers.

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