A new approach to the concept of knowledge strategy

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Abstract

Purpose – This paper aims to present a novel way to conceive knowledge strategy (KS). It suggests that a firm could outperform another by establishing a coherent and integrated KS depending on the objectives pursued and the understanding of knowledge management (KM) by managers, the use of KM tools, and organizational aspects to support KS implementation.

Design/methodology/approach – A cluster analysis was used to study the effect of KS on business performance and innovation based on a cross-sectional sample of Spanish firms. Additional statistical analyses were used in order to develop a taxonomy of KSs.

Findings – The paper shows that the way an organization approaches knowledge management has major implications on the development of their strategy and the outcomes of KS application. Four types of KS are thus described based on the empirical analysis, i.e. proactive, moderate, passive and inconsistent, each of them having different effects on business performance and innovation.

Research limitations/implications – The research is limited to high rate innovation industries. Future studies could include other industries and a more diverse sample of firms.

Practical implications – The conception of KS presented here is a powerful approach that can lead an organization to achieve further innovation and higher levels of business performance.

Originality/value – An integrated and coherent KS has the potential to produce optimal results in terms of technological innovation and business performance.

Keywords Knowledge management, Knowledge strategy, Innovation, Performance, Empirical research

Paper type Research paper

1. Introduction

It is widely accepted that today we live in a knowledge economy (Cornelissen, 2006; Nielsen and Michailova, 2007). In such a context, managers need novel mechanisms to cope with the challenges of creating, sharing and applying knowledge to help their organizations thrive. It is thus necessary for strategic management to either create or renew concepts and tools that suits better a knowledge economy, such as knowledge strategy (KS) (Boisot, 1998; von Krogh *et al.*, 2001; Zack *et al.*, 2009).

A KS, according to Zack (1999), describes the general approach followed by a firm in order to fill the gap between an organization's current and future intellectual requirements in pursuing competitive advantage. Nevertheless, there is no clear agreement on either what KS is, or how to design it. There is even less agreement on what is the most desirable KS for a firm to pursue competitive advantage subject to either internal conditions or environmental characteristics (see for example Bierly and Chakrabarti, 1996; Bierly and Daly, 2007; Choi and Lee, 2003; Hansen *et al.*, 1999; Zack, 1999).

Building on extant literature, this paper proposes that establishing of a KS can be a useful tool in managing knowledge assets that can be the source of competitive advantage (Zack, 1999; Grant, 2002). The paper adds to existing research on KS in a novel way by establishing a KS from a strategy-content perspective. As the concept of KM has been

widely used by researchers taking both descriptive and normative approaches (Lloria, 2008) this paper will stress the benefits of establishing a coherent and holistic KS from both viewpoints:

1. a descriptive vision of how companies establish their KS and the results that they obtain; and

2. a prescriptive one that is focus on what a company could do for designing and positioning a KS to achieve optimal results in terms of innovation and business performance.

Descriptive notions of KS are centered on learning depth and use (Bierly and Chakrabarti, 1996), knowledge-oriented exploitation or exploration activities (Bierly and Daly, 2007; He and Wong, 2004; Revilla *et al.*, 2010; Zack, 1999), or the development of specific processes of KM in order to manage different types of knowledge (Alavi *et al.*, 2005; Choi and Lee, 2003; Hansen *et al.*, 1999; Leidner *et al.*, 2006; Schulz and Jobe, 2001). Prescriptive designs of KS are mostly based on theoretical and ''consultancy'' models (du Plessis, 2007; Robertson, 2004; Sveiby, 2001) that have seldom been empirically validated (Lloria, 2008). In general such models assume that managers can take a broader stance to formulate and implement a KS that aims at achieving organizational objectives. Based on the shortcomings of both perspectives, this paper proposes a comprehensive set of dimensions for KS, i.e. establishment of organizational objectives, company managers' understanding of KM, the use of KM tools, and the implementation support systems, which are empirically analyzed using a sample of technology-intensive firms.

The main argument presented here is that an integrated and coherent KS has the potential to produce better results in terms of technological innovation and business performance. This potential is achieved by organizing the firm's knowledge base to enable knowledge leveraging by embarking on knowledge exploration and exploitation (March, 1991). From the knowledge-based view of the firm, knowledge is considered the most important strategic resource for ensuring an organization's long-term survival and success (De Carolis and Deeds, 1998; Grant, 1996). This importance is due to the belief that certain forms of complex knowledge, such as capabilities or routines, can be valuable, scarce and difficult to imitate by competitors (De Carolis and Deeds, 1998; Grant, 2002; Grant, 1996; Kogut and Zander, 1992; Winter, 1987). Moreover, processes that are linked to the management of capabilities and routines, such as knowledge generation, storage, transfer or application, are instrumental in achieving strategic objectives by harnessing complexity, the creation of new knowledge, and fully exploiting the existing knowledge base (Bierly and Daly, 2002; Earl, 2001; March, 1991; Zack, 1999). In this sense the design of a KS becomes essential to achieve organizational objectives from the coherent use of KM processes in an integrative manner (Maier and Remus, 2002).

By considering knowledge as the main strategic resource and source of competitive advantage, this paper will try to contribute to KM literature by:

- establishing a new approach to KS from a strategy-content perspective, highlighting its advantages and the main differences with regards to existing approaches to KS;

- exploring, through an empirical study in a large sample, distinctive KS patterns, which will enable the development of a taxonomy of KSs; and

- examining the effect of each of the identified strategies on innovation and business performance.

The next section will place the main argument of this paper in the context of KS literature. The authors will then briefly outline the methods used, and then describe analyses of data. From this the paper presents a succinct framework, which shows different types of KS that define the profile of an organization adopting them. Based on the empirical evidence the paper will endeavor to establish when and how a particular KS can be beneficial for an organization. The main conclusions of the study are then outlined, along with limitations and future implications of research.

2. Theoretical background

2.1 The concept of knowledge strategy

Any KS would be based on the establishment of a ''road map'' for the firm to explore and exploit organizational knowledge (Bierly and Chakrabarti, 1996; Zack, 1999). The aim of such road map is to achieve strategic goals – which stem from corporate and business strategies. Therefore, the development of a KS should include all the operations that are referred to in the creation, transfer and application of knowledge. All these can contribute to pursuing competitive advantage through innovation and enhancing efficiency (von Krogh *et al.*, 2001). In turn, a firm can achieve superior performance from its ability to outperform competitors in generating new knowledge and using its current knowledge-base more effectively (Almeida *et al.*, 2003; De Carolis and Deeds, 1998).

Table I summarizes the extant literature on KS. For the most part these studies have developed typologies of KS by interrogating the distinctive dimensions of knowledge. While there is consensus in the connectedness between business and knowledge, there is no a clear agreement on the focus or dimensions a KS may have nor on the specific form that a KS may take in order to be aligned with business strategy.

For example, Maier and Remus (2002) offer a broad vision of the KS, including both aspects of knowledge content (the election between tacit and explicit knowledge) and the management of knowledge processes to attain business objectives. Their study concludes that in the real world of business, KM activities for the majority of firms are neither linked to a well-defined KM strategy nor directly related to a business strategy. Earl (2001) also takes an extensive view of KM strategy from a holistic perspective and elaborates a classification of KS schools of thought according to their orientation, focus or interest domain. Garavelli *et al.* (2004) pose market and community as two extreme KS at opposite ends of a continuum, which depends on dimensions related to culture, structure, human resources behavior and the prevalent type of knowledge and content an organization employs. Haggie (2003) also offers a holistic KS vision which is prescriptive-based and empirically tested, by offering to managers a way to establish a KS based on the driving factors that characterize the environmental and internal aspects of their firms, such as goals and former strategies, business sector features, organizational culture and structure, or the nature of knowledge on which they are focused.

Other authors center on specific aspects that determine a KS, such as the type or source of knowledge the organization commonly uses (Choi and Lee, 2003; Clarke and Turner, 2004; Hansen *et al.*, 1999), the mechanisms and processes used to manage knowledge (Alavi *et al.*, 2005; Leidner *et al.*, 2006; Schulz and Jobe, 2001; Sveiby, 2001; Un and Cuervo-Cazurra, 2004; von Krogh *et al.*, 2001), or the way the organization emphasizes knowledge exploration, exploitation or both (Bierly and Chakrabarti, 1996; Bierly and Daly, 2007; Choi and Lee, 2003; Clarke and Turner, 2004; Hansen *et al.*, 1999; He and Wong, 2004; Leidner *et al.*, 2006; Schulz and Jobe, 2001; Un and Cuervo-Cazurra, 2004; von Krogh *et al.*, 2001).

Notwithstanding the individual contributions towards the construct of a knowledge KS, this paper identifies three gaps. First, most previous work focuses on particular aspects of organizational KM, which from our view gives a partial vision of the KS that a firm could deploy. Secondly, most earlier research does not take into account implementation issues – i.e. aspects for the support of knowledge processes in order to overcome human barriers to KM, such as culture, human resource (HR) management, and leadership (DeTienne *et al.*, 2004). Third, the descriptive perspective adopted by many of the empirical studies makes it difficult for a manager to implement a KS. Even in the more prescriptive-oriented studies (e.g. Haggie, 2003; Sveiby, 2001) the empirical testing through a single case study leaves room for further explanations on how to develop a KS. In order to fill these gaps the next sections proposes a new approach to the concept of KS and an empirical test of a sample of Spanish IT firms.

Table I Typologies for knowledge strategy from the extant literature

Author(s)	Dimensions	KMS typology/taxonomy	Orientation
Bierly and Chakrabarti (1996)	External versus internal learning Radical versus incremental learning Learning speed Knowledge base extent	Explorers Exploiters Loners Innovators	Emp[a]
Hansen et al. (1999)	Type of knowledge Knowledge transfer and sharing	Codification Personalization	Theo[a]
Zack (1999)	External versus internal knowledge Exploration versus exploitation Conservative versus aggressive posture	Explorers Exploiters Innovators External acquisition Internal development Unlimited	Theo
Earl (2001)	Focus Interest Unit Successful critical factors IT main contribution ''Philosophy''	Technocratic: systems; cartographic; engineering Economic: commercial Behaviorist: organizational; spatial; strategic	Theo
Schulz and Jobe (2001)	Type of knowledge Knowledge codification, transfer and sharing	Codification Tacitness Focused Unfocused	Emp
Sveiby (2001)	Knowledge transfer	Nine types of knowledge transfer strategies taking into account interactions between people both inside and outside the organization	Emp
von Krogh et al. (2001)	Knowledge creation Knowledge transfer	Leveraging Expanding Appropriating Probing	Emp
Maier and Remus (2002)	Knowledge type (content) Target group Tools and technologies Culture Processes and organization of KM	Several knowledge management strategies (KMS) in relation to each dimension (process-oriented KMS)	Theo
Choi and Lee (2003)	Knowledge type (explicit vs tacit)	Passive Persons centered Systems centered Dynamic	Emp
Haggie (2003)	Goals Business Sector Characteristics SWOT Value focus Organizational structure and culture Nature of knowledge	Specific KMS depending on the characteristics of the dimensions (driver factors) for the selected firm	Emp
Clarke and Turner (2004)	Knowledge source	External acquisition Internal development	Emp
Garavelli et al. (2004)	Variety and relevance of the abilities (specific knowledge) Abilities applicability Compromise Behavior Atmosphere Management style Type of knowledge Source of knowledge	Knowledge community Knowledge market	Emp
He and Wong (2004)	Knowledge exploration Knowledge exploitation	Exploiters Explorers Mixed	Emp
Un and Cuervo-Cazurra (2004)	Knowledge creation capacity	Project teams Knowledge organization	Emp
Leidner et al. (2006)	Type of knowledge Knowledge codification and transfer	Codification Personalization Mixed	Emp
Bierly and Daly (2007)	Knowledge exploitation Knowledge exploration	Explorers Exploiters Mixed	Emp
Revilla et al. (2010)	Knowledge exploration Knowledge exploitation Environmental complexity Environmental dynamism	High ambidexterity Low ambidexterity Punctuated equilibrium in explorative cycle Punctuated equilibrium in exploitative cycle	Emp

Notes: [a]Theo stands for theoretical and Emp stands for empirical

2.2 An alternative approach to knowledge strategy

This study uses a holistic and content-based approach of strategy, in conceptualizing KS as a managerial instrument. This is built on the formulation of initiatives based on KM and their implementation tailored to the achievement of organizational objectives. From this approach, the paper considers four dimensions which together comprise a firm's KS.

KM vision as used here would be referred to the way top management understands the potential contribution of KM for the firm. For example, top management could either regard KM as merely related to the use of information technologies or, conversely, to consider it a wider concept that includes both human and technical aspects (Huplic *et al.*, 2002). The KM concept would represent the relative importance that it plays in the organization (Choi and Lee, 2003).

KS objectives refer both to the organizational objectives that are important to achieve by the company and the importance given to KM for achieving those objectives. KM may bridge the gap that appears when the organization is stretched to address quality problems, search for efficiency, develop new products, or come up with solutions to customer service failures (Earl, 2001; Zack, 1999). When KM is integrated into organizational objectives, KM tools can be used to foster the accomplishment of such objectives. KS objectives represent the overall perceived relative importance of KM for the organizational strategy and makes KM to be aligned with the business strategy (Zack, 1999).

KM tools refer to the instruments based on KM that a firm could use in order to accomplish organizational objectives. These tools would be specific methods or initiatives used by the organizations to support the creation, transfer, storage, retrieval and application of knowledge. All these elements may include both technical and human components (Alavi and Leidner, 2001; Davenport *et al.*, 1998). As Davenport and colleagues note, KM initiatives look specifically at either creating knowledge repositories, improving knowledge access and transfer or managing knowledge as an asset – including its protection (Davenport *et al.*, 1998). Besides, the organization could either focus on several procedures in a comprehensive manner, or use tools in a more specific way.

Finally, this study considers implementation support mechanisms that are meant to ease the development of KM processes, such as culture, leadership and human resource practices. This dimension includes organizational aspects that are needed to encourage HR to use KM tools and procedures appropriately. A knowledge-centered culture should promote knowledge exchange and sharing allowing innovation (Nonaka, 1994). Knowledge managers will have a key role as knowledge facilitators, promoting work autonomy and experimentation, as both elements are necessary to stimulate creativity (Davenport *et al.*, 1998). Moreover, in order to enable KM processes, and due to the essential changes that KM initiatives have on people, HR practices have to be adopted accordingly. Practices such as the promotion of access to expert knowledge, the development of work teams and communities of practices, incentives methods and monitor and control process systems, stand out as important elements to accomplish organizational strategic knowledge objectives.

From this conceptual development of KS, the research questions that this study draws next are the following: do firms have different behaviors in relation to KS depending on their different visions, objectives and goals? What are the characteristics that define these behaviors? Are there better behaviors than others in terms of innovation and business performance?

This paper tries to respond all these questions by means of an empirical study in a large sample of innovative companies in Spain. The research framework, methodology, and analyses that have been carried out in order to face these issues are all presented in the next section.

3. Methodology, empirical analysis and results

3.1 Research framework

In order to connect the four dimensions noted above the study established a testable KS construct. Based on the existing KM literature, multi-item indicators for all variables were

developed (see Appendix). This construct was tested using a sample of Spanish innovative firms. The record growth of Spain over the decade from 1994 to 2004 provides, in the authors' view, a fertile ground to investigate innovation as a function of KS. The study's aim was to investigate the extent to which KS were carried out by these firms, and elaborate a taxonomy of KM behaviors and their associations with innovation and business performance.

A postal survey was used in May 2004 as a method to collect primary data on KS in industries considered as mainly innovative. These industries included manufacturing of electric materials and equipment, electronic, the optical equipment. A set of questionnaires were sent to a population of 802 employing at least 25 employees in these industries. After a second mailing a month later, 111 valid questionnaires were received completing a response rate of 13.84 percent. SPSS 12.0 for Windows was used as the main tool to process these data (and later to apply the statistical analyses). Multi-item scales were built in order to represent different dimensions.

3.1.1 Empirical analysis. A set of explorative factor analyses, using the principal components method, were applied to check the discriminating validity of the constructs and to confirm the structure of the data (Hair *et al.*, 2001). Chronbach's alpha coefficients yielded acceptable results, demonstrating the reliability of the indicators (see Table II).

Reliability and validity was also tested for process and product innovation and business performance as dependent variables. In addition correlations between these variables and other theoretically related variables as well as factor analyses, based both on primary and secondary data, yielded acceptable results. For example, to check the validity of product and process innovation results, two open questions were included in the questionnaire, asking for the number of innovations of both types obtained during the last year. The correlations with the subjective measures, which were used in the study as dependent variables, were significant, both for product ($r = 0.312$, $p < 0.01$; $n = 83$) and process innovation ($r = 0.327$, $p < 0.01$; $n = 91$).

The selection of the input variables to be included for the cluster analysis was made prior to the application of such analysis, which would ultimately result in four KS. Such input variables were the average of the multi-item scales of the previously indicated constructs (see Table II), which resulted from the explorative factor analyses shown in Table II. It was necessary to calculate the correlation matrix for all variables due to the use of average values as inputs to obtain the clusters the authors. Such matrix shows no evidence of co-linearity as all correlations turned out to be below 0.5 (Hair *et al.*, 2001). The authors also checked that all the variables followed a normal distribution, through the

Table II Dimensions and variables of knowledge strategy: factor analysis for knowledge strategy variables				
Dimensions *Variables*	*Barlett sphericity contrast**	*KMO*	*Explained variance (%)*	*α*
Knowledge management concept (four items)	67.200	0.629	49.32	0.6519
Knowledge strategy objectives (four items)	139.40	0.758	62.31	0.7905
Knowledge management tools	1291.41	0.871	61.90	
Knowledge storage methods (seven items)				0.8618
Knowledge distribution and application methods (nine items)				0.9049
Protection methods based on internal factors (three items)				0.6680
Protection methods based on external factors (three items)				0.7925
Implementation support mechanisms	1066.34	0.913	62.54	
Cultural principles and leadership (11 items)				0.9335
Support based on HR practices (four items)				0.7878
Notes: *χ^2; Significant: 0.000				

Kolmogorov-Smirnov test and the evaluation of the q-q graphs (residues), which yielded acceptable values.

The procedure to undertake the cluster analysis was the Ward's hierarchical clustering technique using squared Euclidean distances to find similarities between cases. The number of clusters was determined through the study of the dendrogram, where the authors established four distinctive clusters due to significant differences detected for these four groups in the application of different ANOVAs (Table III). Post-hoc tests of multiple comparisons (through the Scheffé method) further confirmed significant differences between the four clusters. In order to guarantee that the solution was optimal, the alternative k-means procedure of agglomeration was used resulting in similar clusters to the ones that had been found via hierarchical agglomeration previously.

Any additional detail on the data, its structure, dendrograms, measures, validity, correlation-matrix or any other analyses items used in this research are available from the authors upon request. To favor parsimony this paper reports only the essential findings.

The four resulting clusters, representing distinctive knowledge strategies, were labeled moderate, inconsistent, passive and proactive according to the characteristics they presented. These four strategies and the results of the cluster analyses are described next.

3.2 Results: knowledge strategies

3.2.1 Moderate knowledge strategy. This strategy shows a quite clear notion of KM to carry out KM practices to an acceptable standard. Besides, a moderate knowledge shows the important role played by culture, leadership, human resources (HR) and protection of knowledge. Developing integral knowledge is important for a moderate knowledge strategy, though less than for the proactive explained subsequently. This is the cluster with the highest number of firms (Cluster 1, $n = 40$). Moderate strategy presents high scores overall, second only to cluster 4 (proactive). In fact, this KS scores significantly higher than groups 2 (inconsistent) and 3 (passive) in the KM concept, KS objectives, KM practices, implementation based on culture and leadership, as well as in HR practices. Besides, it exceeds cluster 3 (passive) in the use of knowledge protection methods. Moderate KS shares with cluster 4 (proactive) that both develop an integral knowledge strategy, but moderate KS shows a less aggressive KS than group 4 (proactive).

3.2.2 Inconsistent knowledge strategy. This strategy corresponds to an intermediate position. It represents a strategy in which the firm seems to fully understand KM, but does not take action to turn it into results. This is the second largest cluster after the moderate (cluster 2, $n = 38$). In general, this strategy shows an important contradiction in KM. This contradiction appears as a lack of coherence between their understanding of KM and the specific usage and intensity of KM tools as well as implementation mechanisms.

3.2.3 Passive knowledge strategy. This strategy is the smallest group (cluster 3, $n = 12$). This is the cluster with the lowest average scores in all the variables, which implies a very limited usage of KM tools. This suggests that KS is rendered useless as a tool to achieve strategic objectives by this group of firms. This posture is probably based on a narrow concept of KM, restricted to management of technology, information and communication. Thus, managers in these firms will not consider all the benefits that a comprehensive KS could offer, or ignore KM at all. However, it could be that due to the understanding of KM purely as a technology-driven instrument, firms with a passive knowledge strategy devote isolated efforts to dispersed KM initiatives.

3.2.3 Proactive knowledge strategy. This is the most decisive strategy regarding establishment of objectives, a broader understanding of knowledge as a strategy, usage of KM tools, as well as the importance that it is given to a knowledge-centered culture and other implementation mechanisms. Evidently this cluster shows the highest values for all the variables, but it is not the largest (cluster 4, $n = 21$). This cluster gives great importance to all planned objectives, and deems KS as contributor to their integration. KM is understood in its widest sense within this strategy. This suggests that KM is not only an instrument for the evaluation and quantification of a firm's intellectual capital or a collection of technological

Table III ANOVA for knowledge strategies

Variables	Clusters				Levene-statistic	F	Post-hoc (Scheffé)
	1; n = 40 Moderate	2; n = 38 Inconsistent	3; n = 12 Passive	4; n = 21 Proactive			
KM concept	5.1375 (0.8065)	4.4868 (0.7532)	3.3750 (0.9384)	5.25 (0.9387)	0.455	17.705**	2,3 < 1,4; 3 < 2
KS objectives	5.2335 (0.8931)	4.3773 (0.9357)	3.1161 (0.7651)	6.1301 (0.6142)	2.030	39.010**	2,3 < 1; 3 < 2; 1,2,3 < 4
Knowledge storage	5.6893 (0.7606)	4.5451 (1.1139)	4.5119 (1.0989)	6.1769 (0.7449)	1.819	19.650**	2,3 < 1,4
Knowledge distribution-application	4.9806 (0.7627)	3.5526 (1.0089)	2.722 (0.8130)	5.6296 (0.7246)	1.220	48.482**	2,3 < 1,4; 3 < 2
Knowledge protection (external)	4.1750 (1.0860)	4.8158 (1.0243)	2.333 (1.0050)	5.8889 (0.4753)	3.827	37.217*	3 < 1,2; 1,2,3 < 4
Knowledge protection (internal)	3.7333 (1.3078)	3.9737 (1.2577)	2.00 (0.7247)	5.0476 (0.7978)	2.632	17.923**	3 < 1,2; 1,2,3 < 4
Implementation based on culture and leadership	5.6159 (0.6356)	4.4952 (0.7918)	3.5076 (1.1083)	5.9524 (0.6374)	2.240	41.270**	2,3 < 1,4; 3 < 2
HR practices	4.643 (0.9038)	2.9145 (0.7266)	2.6250 (1.1001)	5.4881 (0.7351)	1.377	61.654**	2,3 < 1; 1,2,3 < 4

Notes: Standard deviations in parentheses; **Significant $p < 0.01$; *Significant $p < 0.05$; Knowledge management concept refers to an organization's strategic orientation regarding knowledge, which is reflected in the way the top management understands the potential contribution of KM for the firm; Knowledge strategy objectives refer to the role KM plays for achieving strategic objectives; Knowledge storage refers to instruments/practices, which are used for the organization to gather, structure, recover and give employees access to knowledge; for knowledge use in the organization; Knowledge distribution-application refers to the practices that are used by individuals and organizational groups in order to transfer and apply the knowledge base of the organization; Knowledge protection (external) refers to methods which are used to protect a firm's knowledge with an external-orientation such as patents, first-to-market advantage and brands; Knowledge protection (internal) refers to methods which are used to protect a firm's knowledge with an internal-orientation such as secrecy, complementary assets and knowledge complexity; Implementation based on culture and leadership refers to those principles and initiatives which a firm can use in order to create and maintain a knowledge-centered environment for supporting the implementation of a knowledge strategy; HR practices refer to those initiatives based on human resources (e.g. incentives, management of teams) that are developed by firms in order to support the implementation of a knowledge strategy

tools, but also a concept of ''abstract'', ''hard'' and ''soft'' perspectives (Huplic *et al.*, 2002). This strategy, albeit followed closely by the Moderate, is the one that gives greater importance to all practices related to KM. In general, the proactive KS appears to have a clear understanding of a KS, which is reflected in practices on KM and other organizational instruments (e.g. HR practices or knowledge-centered culture) used to achieve organizational objectives.

The proactive KS is the one with the widest scope and the most coherent in relation to practices and implementation, when compared to the other three. The moderate KS shares with the proactive a relatively extensive scope and considerable coherence but not as significant as the proactive KS. Conversely, the inconsistent KS appears at the bottom left-hand side, revealing a narrow scope, lack of coherence in knowledge practices and low achievement on implementation mechanisms. Finally, the passive KS presents a narrow scope regarding the understanding of KM, but high coherence in the use of KM tools and implementation mechanisms.

3.3 Possible outcomes of knowledge strategies

Although some strategies appear more energetic than others, suggesting that they can outperform the less active, it is important to know how each of the strategies identified here can help to achieve objectives or some form of measurable result. This study uses innovation and business performance as variables to explain the degree of success of knowledge strategies as they have been broadly utilized in KM research (see, e.g. Bierly and Chakrabarti, 1996; He and Wong, 2004; Revilla *et al.*, 2010; Subramaniam and Youndt, 2005). Innovation variables represent new knowledge developed within the organization, which could be directed either to satisfy customer needs (i.e. products) or to improve organizational activity system (i.e. processes). By business performance in this study the financial and effectiveness results that the organization obtains from utilizing its knowledge base are used (see appendix). The analyses of these performance variables relating to the four knowledge strategies are presented in Table IV.

Regarding overall business performance, the proactive and moderate strategies score significantly higher than the passive strategy, which confirms prior intuition. The inconsistent strategy has no significant effect on performance at all, ratifying its status of ''neither here nor there''. However, on product and process innovation as outcome, the results are somewhat different. The proactive KS shows a clear dominance when compared to the rest of KS in process innovation results. The proactive strategy considers KM in its widest sense, and secondly, it gives importance to KM practices to achieve strategic objectives such as efficiency, quality or customer satisfaction. On process innovation, the moderate strategy is not capable of exceeding the passive or inconsistent strategies significantly, making these three indifferent. When it comes to product innovation the passive strategy is significantly behind the moderate, the inconsistent and the proactive. Also in product innovation as outcome, the proactive strategy, though superior to the rest, is not significantly better that the inconsistent or moderate.

Overall, the results show an evident superiority of the proactive strategy followed by the moderate strategy when it comes to achieving desired organizational outcomes. The results

Table IV	ANOVA: business performance and innovation results						
		Clusters					
	1; n = 40	*2;* n = 38	*3;* n = 12	*4;* n = 21			*Post hoc*
Variables	*Moderate*	*Inconsistent*	*Passive*	*Proactive*	*Levene-statistic*	F	*(Scheffé/T2 Tamhane)*
Business performance	4.90 (0.78)	4.56 (0.86)	3.77 (1.14)	4.77 (0.94)	0.957	5.263**	3 < 1,4**
Process innovation	5.44 (0.89)	4.76 (1.19)	4.27 (1.11)	5.97 (0.60)	4.05		2,3 < 4**
							1 < 4*
Product innovation	5.54 (0.90)	5.40 (1.05)	4.00 (1.18)	6.05 (0.74)	1.59	12.02**	3 < 1,2,4**
Notes: Standard deviations in parentheses; **Significant $p < 0.01$; *Significant $p < 0.05$							

for the passive strategy suggest that, if a firm aims is to be innovative, they will have to alter their understanding of KM. To aim at being innovative their KS will have to be more proactive. The inconsistent KS, albeit unable to achieve significant results, can stay above the passive on product innovation and it is not much worse than the moderate and proactive strategies on product innovation.

3.4 Profiles for an organization following each knowledge strategy

This section describes in detail the profiles of an organization following each of the four KS identified through the cluster analysis. Addressing specific aspects, this section provides a description that may allow practicing managers to recognize which KS their organizations could be employing. With that aim, Table V characterizes the four KS across its component attributes.

As a complement, Figure 1 shows the schematic profile of the different knowledge strategies, based on the assessment of the variables that together constitute the overall concept.

An organization using a passive KS will be clearly positioned towards the left of Figure 1. This would indicate that not much attention is paid to KM in general and probably KM will not be considered to be potentially helpful in achieving organizational objectives. An organization taking a passive strategy will, however, carry out knowledge storage practices. In order to carry out operational activities or processes a number of information and communication technologies (ICT) would typically be in use. In general, it could be argued that the passive KS is associated with the competitive conditions. Specifically, in niches where technology and innovation are not considered to be essential competitive tools and cost pressures are intense, a passive KS is likely to be found.

An organization employing an inconsistent KS will be characterized by the incoherence between the different aspects of KM. For instance, they would give just an average importance to KM as an instrument to get organizational objectives, but paradoxically a low priority to the usage of knowledge distribution-application tools and HR practices. The former is not consistent with magnitude of the later, which will hamper the achievement of objectives. In addition, under an inconsistent KS, importance would be assigned to knowledge protection tools, such as patents, which does not agree with the lack of interest for KM tools. Possibly, short-term opportunistic behavior could explain this contradiction. It could be argued that this type of KS would show preference for managing explicit knowledge, and obtain technologies that could be quickly incorporated into new products, and in turn be patented. Due to such practices, this type of KS would not regard HR practices highly, focusing relatively more on ICT and implying that the ''technical'' vision on KM takes priority over, the otherwise relative long term, HR development approach.

An organization following a moderate KS would be typically achieving second best results from their innovation efforts. Although a moderate KS may produce reasonable performance, this strategy would not be as effective as the proactive in their process of innovation. While relatively active and energetic compared to the passive and the inconsistent, organizations using a moderate KS will not be at the highest competitive level. Firms following a moderate strategy tend to deem knowledge as very important to achieve strategic objectives, which is coherent with the consideration that it is given to KM by managers. However, among these firms one will probably find relatively stagnated firms, acting either as followers or in mature markets. Moderate strategies are likely to emphasize only incremental product innovations, for which neither external protection (pioneering, patents, brands) nor internal protection (knowledge complexity, secrecy) are essential tools. These firms will, nonetheless, maintain their competitive drive in the market as they actively use KM storage practices, such as databases or handbooks; as well as tools for knowledge transfer, such as communities of practices or those tools based on ICT.

Organizations that could use a proactive KS are the complete opposite to a passive strategy. This type is profiled at the right of Figure 1, making the best use of all KM elements. This strategy appears to produce the best possible results both in innovation of products and

Table V Descriptive profiles for each knowledge strategy

|	Moderate	Inconsistent	Passive	Proactive
KM concept	Medium-high breadth: KM is understood as a powerful tool that includes creation storage, transfer, application and protection practices to get organizational objectives	Medium breadth: KM is understood as a powerful tool that includes creation storage, transfer, application and protection practices to get organizational objectives	Narrow breadth: KM is understood as linked to Information and computer technology (ICT) tools to manage explicit knowledge	High breadth: KM is understood from cultural, technical and human viewpoints, as well as considered vital to achieve organizational objectives
Knowledge strategy objectives	Medium-highly broad scope: KM is a relevant framework to get organizational goals such as quality improvement, efficiency, innovation or to solve customer satisfaction problems	Medium scope: KM is a tool that can be sometimes useful to get organizational goals related to innovation quality improvement, efficiency, innovation or to solve customer satisfaction problems	Narrow scope: KM does not seem to be an important tool in order to get organizational objectives such as quality improvement, efficiency, innovation or to solve customer satisfaction problems	Highly broad scope: Stress is put on KM as an essential strategic framework to get organizational goals such as quality improvement, efficiency, innovation or to solve customer satisfaction problems
Knowledge storage	Medium-high importance: tools to gather information and knowledge (e.g. databases, handbooks, data warehousing) are broadly used in the organization	Medium importance: tools to gather information and knowledge (e.g. databases, handbooks, data warehousing) are often used in the organization	Medium importance: tools to gather information and knowledge (e.g. databases, handbooks, data warehousing) are often used in the organization	Very high importance: tools to gather information and knowledge (e.g. databases, handbooks, data warehousing) are profusely used in the organization
Knowledge distribution-application	Medium-high importance: tools and practices used to disseminate and share knowledge are often developed, such as community of practices, meetings, the use of ICT tools or the sharing of best practices	Low importance: practices and tools to disseminate information and knowledge such as meetings, the use of ICT tools or communities of practices are scarcely used in the organization	Unimportant: practices and tools to disseminate information and knowledge such as meetings, the use of ICT tools or communities of practices are hardly ever used in the organization	High importance: tools and practices used to disseminate and share knowledge are developed in abundance, such as community of practices, meetings, the use of ICT tools or the sharing of best practices
Knowledge protection (external)	Medium importance: knowledge protection mechanisms such as brands, first-to-market advantage or patents are sometimes used by the organization	Medium-high importance: knowledge protection mechanisms such as brands, first-to-market advantage or patents are often used by the organization	Unimportant: knowledge protection mechanisms such as brands, first-to-market advantage or patents are hardly ever used by the organization	High importance: knowledge protection mechanisms such as brands, first-to-market advantage or patents are very frequently used by the organization

(Continued)

Table V

	Moderate	Inconsistent	Passive	Proactive
Knowledge protection (internal)	Low importance: knowledge protection mechanisms such as complementary resources, knowledge complexity or secrecy are barely used by the organization	Medium importance: knowledge protection mechanisms such as complementary resources, knowledge complexity or secrecy are sometimes used by the organization	Unimportant: knowledge protection mechanisms such as complementary resources, knowledge complexity or secrecy are almost never used by the organization	Medium-high importance: Knowledge protection mechanisms such as complementary resources, knowledge complexity or secrecy are frequently used by the organization
Implementation based on culture and leadership	Medium-high importance: principles based on a knowledge-centered culture (e.g. tolerance to errors, common language and vision) and a leadership based on the promotion of cooperation and knowledge sharing are used to some degree in the organization	Medium importance: principles based on a knowledge-centered culture (e.g. tolerance to errors, common language and vision) and a leadership based on the promotion of cooperation and knowledge sharing are normally implemented in the organization	Medium-low importance: principles based on a knowledge-centered culture (e.g. tolerance to errors, common language and vision) and a leadership based on the promotion of cooperation and knowledge sharing are barely used in the organization	Very high importance: principles based on a knowledge-centered culture (e.g. tolerance to errors, common language and vision) and a leadership based on the promotion of cooperation and knowledge sharing are intensively implemented in the organization
Support based on HR practices	Medium-high important: Practices that favor HR storage, sharing and in general usage KM tools (e.g. incentives, training, empowerment, team problem-solving) are normally used in the organization	Low importance: Practices for charging HR with the responsibility to storage, share and in general to use KM tools (e.g. incentives, training, empowerment, team problem-solving) are scarcely used in the organization	Unimportant: Practices for where HR store, share and or use KM tools (e.g. incentives, training, empowerment, team problem-solving) are almost never used in the organization	High importance: Practices for charging HR with storage, sharing and in general to use KM tools (e.g. incentives, training, empowerment, team problem-solving) are very frequently used in the organization

Figure 1 Schematically represented profiles of knowledge strategies

Key

Moderate ■; Inconsistent ▲; Passive ●; Proactive ★
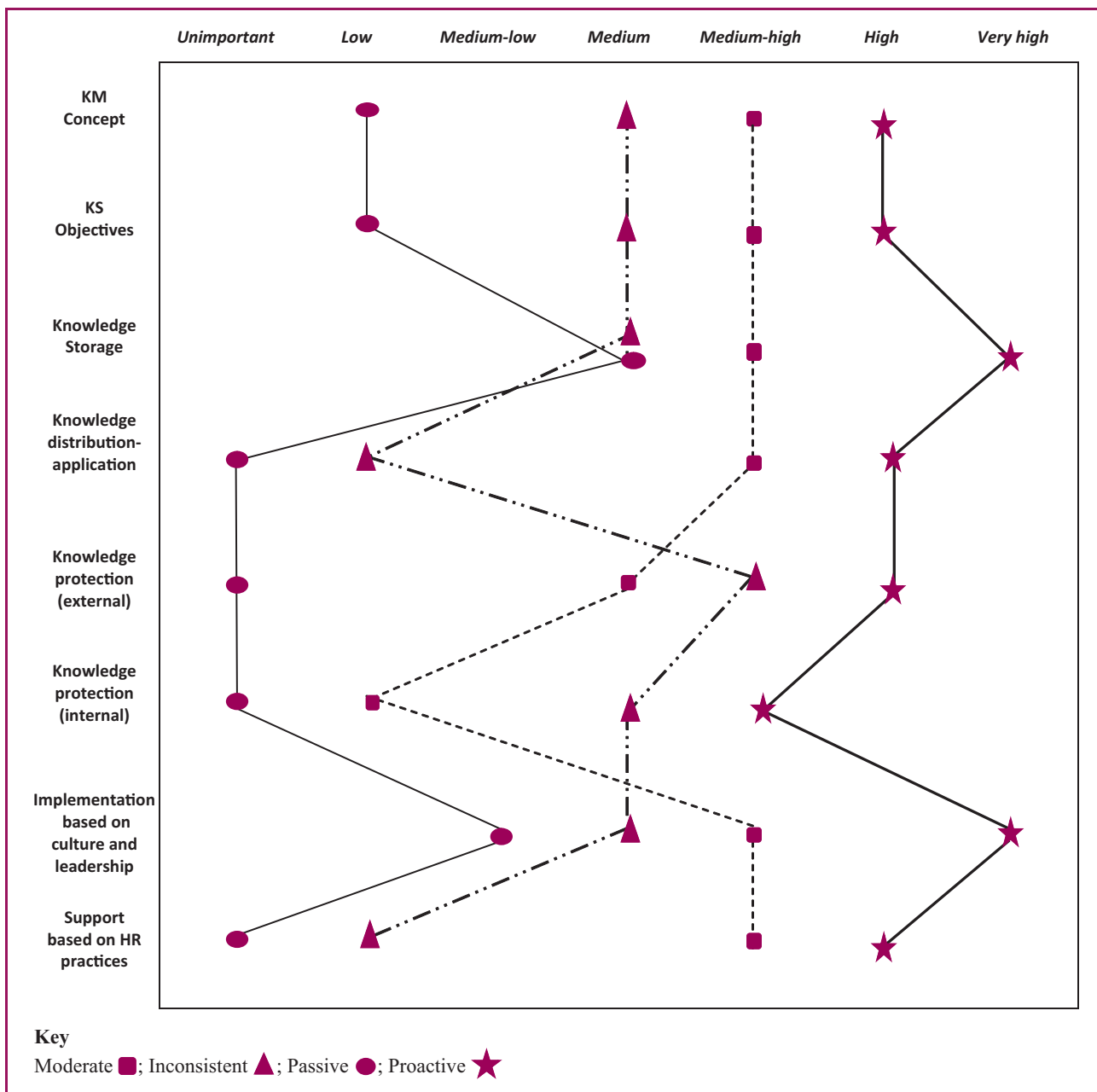
processes and also in business performance. This strategy is actually followed by the most innovative firms as they attempt to respond in a timely manner to change. It would be natural to think that this strategy engenders dynamic capabilities due to the fact that KM is understood as an all-encompassing concept geared to achieve strategic objectives (Eisenhardt and Martin, 2000; Teece *et al.*, 1997). Activities as quality improvements to enhance efficiency as well as providing customers with the solution they seek are regularly carried out. Organizational knowledge is stored allowing trouble-free retrieval and easy access across the organization, using techniques such as data warehousing and databases. Communities of practice, meetings and ICT tools allow for smooth knowledge transfer. Besides, knowledge is protected both internally and externally, driven by a knowledge centered culture. Errors, though not sought, are considered an opportunity to

learn and cooperation is highly valued. All the above is facilitated by HR practices that empower employees.

This ideal strategy can be challenging though, as it requires significant investment of resources. It would need development of management capabilities as well as in developing, storing, retrieving and using knowledge. Hence, this strategy appears to be apt when the rewards associated with it are high.

3.5 Changes in knowledge strategies

These four profiles only highlight different strategies, which are points in a continuum, and have the purpose of illustrating means to achieve specific ends. It is important to add a dynamic element by describing the necessary steps and rationale to move from one strategy to another. In a first instance, each organization might be able to relate to each of the four strategies. Once identified with either one or two, one might want to contrast a possible change in strategy, evaluating both whether it is the best use of resources and the current environment against expected outcomes.

The cluster analysis that produced the four types of strategies could be represented graphically using two axes. Axis 1 is labeled ''level of coherence in the use of KM tools and implementation mechanisms'' and it comprises the dimensions of KM tools and Implementation support mechanisms. Axis 2 is labeled ''breadth of the concept of knowledge management'' and it includes the dimensions of KS objectives and KM concept. These axes are the best fit to synthesize the four dimensions described previously. This graphic representation is shown in Figure 2.

It seems compelling for an organization with a passive KS to improve its performance by attempting to be more innovative. This change may be triggered by a change in environmental conditions or by a mere need to introduce product innovation. It will prove difficult for a firm in such position to achieve a dramatic change in its trajectory in the short run. The faster the change the more resources will be needed, hence adaptation would be less traumatic if developed progressively.

First, it would be advisable to introduce both a technical approach (ICT infrastructure) and a human-centered perspective (based on the introduction of cultural principles and leadership and HR support practices). The introductions of both complementary elements will help achieve the full potential of the infrastructure deployed. Second, efforts can be taken towards the acceptance of the essential role that KM has for attaining organizational objectives, *de facto* enhancing their concept of KM. Consequently, the best option for a firm whishing to change its passive KS would be to aim at adopting the profile of a moderate

Figure 2 Types of knowledge strategy
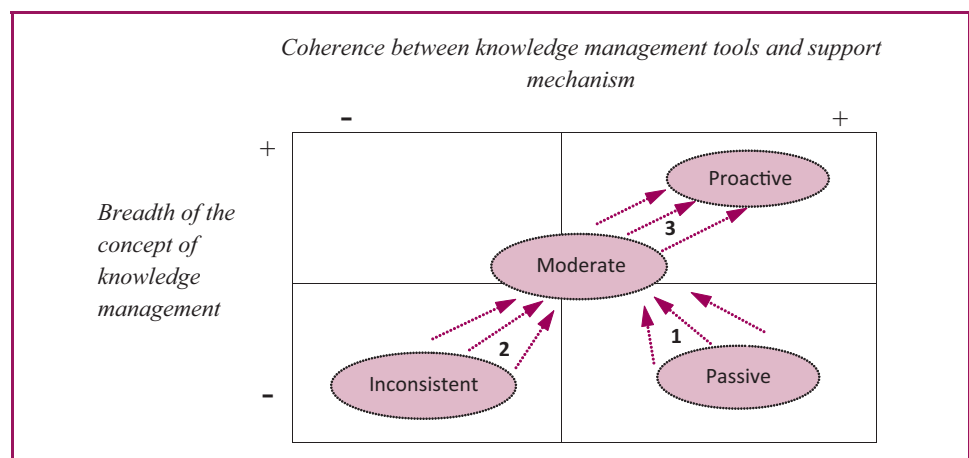
strategy. Any further attempt might be unreachable in the short run but possible as a long-term goal. This possible movement is represented by arrows number 1 in Figure 2.

Secondly, a firm may also wish to consider a change from an inconsistent position. Again, the most feasible option could be to move towards a moderate strategy represented by arrows number 2 in Figure 1. In so doing, a relatively more coherent position can be achieved and the concept of KM can be enhanced. As with the previous move, this change could also be an intermediary stage as part of a long-term move to a more proactive strategy. When compared to a passive strategy however, the inconsistent has the advantage that the KM concept is already known by managers; the problem here is about focus. Their emphasis in ICT and technical infrastructure appears as their dominant paradigm; making attempts to leverage its knowledge resources will only be possible by adding the HR side of KM. In particular, the movement from an inconsistent to a moderate strategy has to be based on the following elements. First, on expanding the concept of KM to a more human-based perspective; second, on giving more importance to KM as a means for the attainment of objectives; third, on developing and using more tools of knowledge transfer as part of a knowledge-centered culture; and finally and perhaps more importantly, by giving a major role to HR for the development of KM processes.

The underpinning rationale that would lead a firm in either a passive or inconsistent position to move to a moderate strategy is that this strategy shows very acceptable results without demanding excessive investment and resources. In fact, the moderate strategy is as good as the proactive in terms of business performance and product innovation. Besides, it is likely that a firm with either a passive or an inconsistent KS will adapt easier to a moderate strategy. Though a move of this sort would imply changes in processes, organization, focus, behaviors and managers' minds in relation to KM, they are of less magnitude than changes to achieve a proactive KS.

Thirdly, the adoption of a proactive KS could be helpful for an organization willing to take part in a very dynamic competitive environment. This change is illustrated by arrows number 3 in Figure 2. Under a relatively dynamic competitive landscape a proactive strategy would yield the most possible innovation, which could become a key success factor. When environmental pressures push a firm to move from a moderate KS towards a proactive, it will require both improvements in all processes and a higher intensity in KM practices. In order to pre-empt such pressures, efforts to intensify KM practices may be helpful, not least to foster organizational survival. In order to make this change possible, KM will be placed at the core of organizational processes and fully integrated into corporate and business strategies. Managers across the organization will champion knowledge and in so doing develop a shared vision of KM as the driver of innovation and growth. Additional technical, such as ICT, and organizational investments, such as incentive schemes and training, will support such new approach to knowledge. Finally, as these efforts are reinforced a culture centered on knowledge will emerge. Hence, within a knowledge culture, exploration and exploitation processes will develop and will eventually payoff resources allocated for KM.

Clearly, the change from one to another strategy will not occur without investments and allocation of resources. It might be that organizations with passive or inconsistent strategies will find it problematic to change if they are constrained by rigidities, which are hard to overcome (Leonard-Barton, 1992). Nurturing a knowledge culture will be the perfect complement to financial investments. Significant use of time and resources will be necessary.

For instance, new technology systems based on ICT will have to be acquired and implemented to improve storage, distribution and application of knowledge (Gloet and Berrell, 2003). Technical support is also likely to be necessary in order to help on making the best of the new systems. HR practices will have to be revamped to aid KM efforts. Possibly incentive systems will become important to foster practices of knowledge storage and transfer and overcome the previous unwillingness to share knowledge. Perhaps training will be the most powerful tool in relation to HR management. The aim of training will have to be to enable the organization to be more flexible, and at the same time, to increase intellectual

capital (Subramaniam and Youndt, 2005). Changes in strategy will probably change the type of employee needed. For this reason, the recruitment policy will most probably need adapting to attract those people who are the best suitable.

4. Discussion

The study reported here illustrates several options for managers to devise a KS. Indeed, a KS can take several shapes; it may affect innovation and be taken on board in different degrees. From the authors' viewpoint, the main dimensions of a KS are the breadth of the concept of KM and the coherence with which the concept is implemented. These dimensions are not only built into an overarching framework for a KS, but they also highlighted distinctive knowledge strategies, their profiles and pros and cons.

It could be argued that if knowledge is first explored and then exploited any organization has a KS. However, the way an organization approaches KM will depend on the competitive environment confronting it, its mission, resource availability, history and size, among other aspects (Bierly and Daly, 2007; Haggie, 2003; Maier and Remus, 2002). Managers should bring together these contingent conditions to design their KM approach, by selecting KM elements that contribute overall to achieving strategic objectives.

Also, managers will find it necessary to evaluate which resources are needed to reach the desired KS position (Bierly and Chakrabarti, 1996). This analysis implies trying to identify what kind of knowledge the organization already possesses, discriminating which knowledge is worth exploiting and hence protecting; and finally what knowledge can and need to be developed in order seek future strategic objectives.

Coherence in KS is an important aspect to consider. This study suggests that coherence among the concept of KM for management, breath of KS objectives, KM tools and implementation support elements is essential to achieve high returns from a KS development. The competitive strategy will also have to be developed by building up KM ingredients in a balanced fashion and with them head towards a long-term vision (Zack, 1999).

In addition, it is important to highlight the human side of KM. In order to overcome issues and encourage KM tools for being (rightly) used, support elements such as culture, leadership and knowledge-oriented HR practices have to develop (DeTienne *et al.*, 2004; du Plessis, 2007). It is often the case that KM is seen as mere information technology tools, yet unless human resource policies match KM development little or no advantage will emerge (Gloet and Berrell, 2003; Soliman and Spooner, 2000). Organizational members are those who ultimately manage knowledge. This is the rationality behind having a successful KS when it involves such members both in the design and use of KM tools and mechanisms.

4.1 Contributions to KM theory

This paper endeavors to address both what a KS is and how such a concept could be operationalized for managers. The paper has constructed the notion of KS from basic dimensions drawn from the literature, and through empirical investigation, to construct a matching profile for each KS type. In doing so, the work on the knowledge based-view has been extended by shedding light upon the processes that can build up knowledge capabilities (De Carolis and Deeds, 1998; Grant, 2002; Grant, 1996; Kogut and Zander, 1992; Winter, 1987). Based on the existing literature, this paper brings together the key elements that comprise a KS to address how and when a knowledge strategy can be beneficial. The design of a KS is based on the identification of gaps in KS research and a prescriptive perspective of strategy (see for instance Andrews, 1971).

This paper has been drawn two approaches to KS, descriptive and normative. The descriptive view has shown a taxonomy of KS based on a series of dimensions. It has explained the positioning of firms depending on the breath of KM understanding for firm managers and the coherence between the KM tools and KS supporting mechanisms. By contrast, the prescriptive perspective highlights the way a firm would have to establish its KS

to take advantage of its competitive positioning. That is by taking into account the four dimensions that comprise a KS and moving itself through the ''KS map'' depending, for example, on changes in its corporate or business strategies and/or the competitive environment. Although other variables such as environmental dynamism are not incorporated in the model, it is likely that firms in ultra-dynamic settings have to be very proactive with regards to KM. In addition, a change in the external conditions for a firm will require a change in its KS in order to adapt and accommodate to the new situation.

By means of contrasting the strategy profiles described here with specific organizations, a road map can be drawn in order to achieve corporate goals. This paper addresses design issues on the operations that refer to the creation, transfer and application of knowledge. Addressing these issues complements the body of work that is based on how the ability to both generate new knowledge and use the current base becomes a competitive tool (Almeida *et al.*, 2003; De Carolis and Deeds, 1998).

The paper contributes to the field of the knowledge-based view of the firm by extending the notion of knowledge strategy. In contrast to previous partial views of this concept, this study proposes a more comprehensive KS conception with four main dimensions, which comprises aspects from both formulation and implementation of strategy. In this paper knowledge is considered as the main strategic asset for the firm and it is stressed that a coordinated and coherent strategy will be essential in order to make the most of the processes of knowledge creation, storage, transfer and application (Grant, 2002).

This paper highlights that a KS will be preferable, in the pursuit of an organization's objectives, when internal characteristics are coherent and integrated. As Kogut and Zander (1992) assert, organizations provide high-order principles that give a rationale to develop internal activities in a superior way to the market. These principles are guides that help the organization to build dynamic knowledge-based capabilities (Teece *et al.*, 1997). Such principles are mostly embedded into the organizational culture and mission, and thus reflected on the knowledge strategies developed over time. If these strategies are not sufficiently developed or show no coherence between KM and organizational objectives, the organizations will not adapt to the environment and will lose opportunities, which will result in both poor innovation and performance.

5. Limitations, final remarks and conclusion

As most, this paper is not free from limitations. The empirical study was carried out entirely in Spain and cultural elements may be part of the explanation. Future research could thus include more countries in order to contrast results. As a cross-sectional study, this study does not analyze cause-effects relationships between variables that evolve over time. A longitudinal design could look at the changing-path of knowledge strategies and the consequent evolution of innovation results and business performance. Besides, more complex models could be tested via multivariate statistical techniques. For example, structural equation models (SEM) could be applied in order to analyze the selection of a specific KS depending on the environmental dynamic conditions. In turn, this could be introduced in the model as a moderating or mediating variable.

KM can become the engine to develop strategy. The way an organization develops new businesses and new markets will be based on an ongoing process of scrutiny of opportunities, where new knowledge can be obtained or existing knowledge can be applied These can be accomplished via different means such as, internal development, M&As or strategic alliances. Thus, organizational boundaries will be based on the knowledge the organization is able to create, assimilate, and exploit to gain and maintain competitive advantage (Kogut and Zander, 1992).

In sum, this paper has provided an integrative notion of KS based on KM elements. This notion not only is an actionable tool for practicing managers but also a further theoretical development. A KS may take different shapes depending on the objectives the organization wishes to achieve. Attributes as balanced and paced development, coherence and a solid

relationship between HR and KM as well as resource considerations, have a significant effect on the success of a KS.

This paper has contributed both to descriptive and normative views of the KS. It has described and tested how a KS can be developed and a typology of different KSs has been established from the empirical analysis. From the prescriptive approach the strategy-content posture allows managers to take into account how to build a KS and where the firm is positioned to face new challenges. To conclude, this study has shown a new approach to the KS concept and has highlighted it as an instrument that may be very helpful for practicing managers as a driver for innovation and business performance.

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Appendix

Knowledge strategy

KM conception (items developed from the works of Alavi and Leidner, 2001; Earl, 2001; Huplic *et al.*, 2002). For the company, KM is (from 1 – totally disagree to 7 – totally agree):

1. A concept integrated within the company's culture, which facilitates the exchange of information, knowledge and experiences between employees and departments.

2. A concept related to the information technologies use, such as data bases or intranets.

3. An array of methods and tools used for the creation, transfer and application of knowledge to achieve firm objectives and goals.

4. A tool for evaluating and quantifying the firm's intellectual capital.

KS objectives. Importance of each objective for the company and importance of KS for its fulfillment: (from 1 – very low to 7 – very high):

1. Product/service quality improvement.

2. Cost reduction (efficiency).

3. Innovation capability improvement.

4. Customer service improvement.

Knowledge management tools

Storage (items developed or adapted from the works of Alavi and Leidner, 2001; Davenport *et al.*, 1998; Davenport *et al.*, 1998; Bontis et al., 2002). In the company: (from 1 – totally disagree to 7 – totally agree):

1. Organizational procedures are documented through quality rules, handbooks, etc.

2. There are databases that allow gathered knowledge and experiences to be used later.

3. There are phone or e-mail directories (referring to departments) to find an expert in specific area.

4. It is possible to access knowledge repositories, databases and documents through some kind of internal computer network (such as intranet).

5. There are customer databases with updated information about them.

6. Databases are frequently updated.

7. There are procedural handbooks about problems and methods that have been successfully applied.

Transfer and application (items developed from the works of Alavi and Leidner, 2001; Bontis *et al.*, 2002; Davenport *et al.*, 1998; Wang and Ahmed, 2004). In the company: (from 1 – totally disagree to 7 – totally agree):

1. Periodical reports are made and distributed to all organizational members in which the firm's achievements are explained.

2. Periodical meetings are accomplished to inform the employees about organizational developments.

3. There are formal mechanisms to allow the sharing of best practices between areas and/or departments.

4. There are projects with interdisciplinary teams in order to share knowledge.

5. There are some employees that compile suggestions from employees, customers and suppliers and distribute structured reports of these within the firm.

6. There are communities of practices or groups of learning to share knowledge and experiences.

7. All employees can access organizational data bases and repositories.

8. Customer suggestions are frequently incorporated into products and services.

9. New knowledge is structured in modules to create new, different applications.

Protection methods (items developed from the work of Grant, 2002). Importance of these protection mechanisms for the company: (from 1 – very low to 7 – very high):

1. Patents.

2. Secrecy.

3. Knowledge characteristics (innovation complexity).

4. Complementary assets (marketing skills, financial resources access, distribution channels, etc.).

5. To be the first into the market (pioneer).

6. Brands and/or the firm's reputation.

Implementation support systems

Cultural principles and leadership (items developed from the works of Nonaka and Takeuchi, 1995; Quinn *et al.*, 1996; Davenport *et al.*, 1998; Rosembloom, 2000; DeTienne and Jackson, 2001). In the company: (from 1 – totally disagree to 7 – totally agree):

1. There is a common language to support knowledge exchange and sharing between employees and departments.

2. Employees experiment and implement new ideas in their working day.

3. Mistakes are a learning consequence and they are tolerated up to a certain limit.

4. The firm's culture is based on confidence and openness.

5. We encourage employees to share knowledge, at an informal level.

6. Employees have responsible behavior and a high learning disposition.

7. All organizational members perceive the same purpose and they feel bound to it.

8. Leadership generates qualities towards responsible behavior of teams and employees.

9. Directors assume their role of knowledge managers, based on facilitating the sharing and transfer processes, and in the mediator role to achieve organizational objectives.

10. Managers act as assessors. Controls are just an evaluation of the objectives.

11. Managers promote the acquisition of external knowledge.

Support based on HR practices (items developed from the work of Quinn *et al.*, 1998; Davenport *et al.*, 1998). In the company (from 1 – totally disagree to 7 – totally agree):

1. Managers reward employees who share and apply knowledge.

2. We have developed financial/non-financial incentive systems to reward teams, instead of individual systems.

3. We have developed programs of internal rotation that facilitate employees to move from one function/department to another.

4. We have set up some methods to assess and control the knowledge management processes.

Business performance (items developed from Venkatraman and Ramanujan's (1986) recommendation of including both financial and effectiveness results). Company performance assessment (from 1 – very low to 7 – very high):

1. Average sales growth for the last year.

2. Average sales growth for the last year compared with its major competitors.

3. Average sales growth for the last year compared with the industry average.

4. Average return on sales for the last year.

5. Average return on sales for the last year in comparison with its major competitors.

6. Average return on sales for the last year compared with the industry average.

7. Average return on equity for the last year.

8. Average return on equity for the last year compared with its major competitors.

9. Average return on equity for the last year compared with the industry average.

10. Degree of fulfillment of the organizational objectives in the last year.

Process innovation (items adapted from the work of Zahra and Das, 1993; Zahra and Bogner, 1999). Assessment of the level of results obtained in the last year for the company (from 1 – very low to 7 – very high):

1. Development of new production methods and procedures.

2. Development of improvements for existing methods and procedures.

3. Introduction of more new (or improved) methods and procedures than its major competitors.

4. Introduction of more new (or improved) methods and procedures than 3 years ago.

Product innovation (items adapted from the work of Zahra and Das, 1993; Zahra and Bogner, 1999). Assessment of the level of results obtained in the last year for the company (from 1 – very low to 7 – very high):

1. Development of new products.

2. Modification and/or improvement of existing products.

3. Introduction of more new (or improved) products than its major competitors.

4. Introduction of more new (or improved) products than three years ago.

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