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Studying the effect of HRM practices on the knowledge management process

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Abstract

Purpose – This paper aims to study the effect of HRM practices on the knowledge management process, focusing on HRM practices both in isolation and forming a knowledge-oriented HR system.

Design/methodology/approach – After reviewing the relevant literature, the paper empirically analyzes the relationship between knowledge-oriented HR practices and the processes of knowledge acquisition, distribution, interpretation and storing, using a sample of 701 firms.

Findings – Findings provide evidence of a positive relationship between the adoption of a knowledge-oriented HR system and each of the knowledge management processes, but also show that the HRM practices comprising that system have different effects on the knowledge management processes.

Research limitations/implications – The main limitations of this paper are the cross-sectional design of the empirical research and the fact that data were collected from one source only.

Practical implications – Findings can guide managers hoping to enhance the development of organizational knowledge. They show that HRM practices may foster all the knowledge management process when they are adopted jointly, as a system of consistent knowledge-oriented HRM practices. The paper also suggests some particular HRM practices that systems should include.

Originality/value – Although literature suggests that HRM can play a key role in knowledge management, little empirical research has explicitly examined the relationship between HRM and each of the knowledge management processes – that is the main purpose of this paper. In addition, the paper defines which practices should be included in a knowledge-oriented HR system.

Keywords Human resource management, Knowledge acquisition, Knowledge dissemination, Knowledge interpretation, Organizational memory, Knowledge management, Competitive advantage

Paper type Research paper

Introduction

Over recent decades it has been increasingly recognized that intangible assets can play a key role in obtaining a competitive advantage for a company (Barney, 1991; Amit and Schoemaker, 1993; Grant, 1996; Remco and Dennis, 2009). One of the intangible assets which are attracting a growing attention in the last decades is organizational knowledge. Today, there is a general agreement that the ability to manage knowledge is vital for success in almost any organizations (Grant, 1996; Hansen *et al.*, 1999; Cabrera and Cabrera, 2005) In other words, literature highlights that any company, in order to be competitive, should create new knowledge, share it across organizational entities, and rapidly embody it in new technologies and products (Schlegelmilch and Penz, 2002).

The authors acknowledge the funding received from CajaMurcia Foundation and from the Spanish Ministry of Science and Technology (research project ECO2009-12825) to undertake this research.

Personnel Review
Vol. 42 No. 1, 2013
pp. 28-49

0048-3486
DOI 10.1108/00483481311285219

The importance of knowledge management (KM) for any company's success is reflected in the growth of publications on this topic from a broad range of management research fields (Minbaeva *et al.*, 2009) and also explains the interest in the literature on studying how to enhance KM. Among the variables that are cited as antecedent of KM, in the last years literature highlights the role of human resources (Currie and Kerrin, 2003; Oltra, 2005; Edvardsson, 2008; Minbaeva *et al.*, 2009).

The basic assumption in the relationship between human resources and KM is that the firm's capacity to create new knowledge resides in their employees' abilities to learn and in their motivation to share their knowledge with their colleagues. Since human resource management (HRM) practices are the primary means by which firms can influence the skills, attitudes and behavior of individuals, they can be instrumental in knowledge creation and development within the firm (Dodgson, 1993; Kamoche and Mueller, 1998; Currie and Kerrin, 2003; Edvardsson, 2008; López-Cabrales *et al.*, 2011).

Despite the recognition of a positive relationship between HRM and KM, many KM initiatives tend to neglect human issues (Oltra, 2005; Chen *et al.*, 2011) and research on this field remains in its infancy (Minbaeva *et al.*, 2009). In this line, Theriou and Chatzoglou (2008) suggest that specific linkages between HRM practices and the KM capability have not been clearly made. Furthermore, few studies have explored the impact of HRM practices on the processes comprising KM. Most of previous researches on the effect of HRM on KM adopt a partial approach. Some of them have focused on one particular HRM practice (Jerez-Gómez *et al.*, 2005; Foss *et al.*, 2009) or one specific KM process, mainly knowledge sharing (Cabrera and Cabrera, 2005; Camelo-Ordaz *et al.*, 2011; Foss *et al.*, 2009; Chen *et al.*, 2011; Liu and Liu, 2011), without a complete vision of the issue.

This present paper adopts a broader perspective and aims to study the relations between HRM and the whole process of KM. We focus on different HRM practices both in isolation and forming a knowledge-oriented HR system. We begin with a review of the relevant literature. From this review we identify the HRM practices which are expected to foster KM and why. We name them as knowledge-oriented HR practices. Then we empirically analyze the relationship between those knowledge-oriented HR practices and the four phases of the KM process defined by Huber (1991). We conclude by discussing the implications of this study for HRM and KM.

Theoretical framework

The role of human resources in knowledge management

KM has been defined in a variety of ways but is generally understood as the process of creating, acquiring, capturing, sharing and using knowledge within an organization to enhance its learning capability and performance (Grant, 1996; Spender, 1996; Scarbrough *et al.*, 1999).

Different models have defined the process of KM and the phases it comprises (Huber, 1991; Nevis *et al.*, 1995; Snell *et al.*, 1996; Romme and Dillen, 1997; Crossan *et al.*, 1999; Schlegelmilch and Penz, 2002). Following Huber (1991), the KM process includes four phases: knowledge acquisition, knowledge distribution, knowledge interpretation and organizational memory.

Knowledge acquisition is the process the company uses for obtaining new information and knowledge (Huber, 1991). Learning involves the search for, and assimilation of both external and internal information and knowledge

(Leonard-Barton, 1992). Irrespective of whether knowledge is acquired from within the company or from outside, the ability and motivation of employees to assimilate new information is considered to be the main determinant of this process (Senge, 1990; Ulrich *et al.*, 1993; Kim, 1998).

Knowledge distribution comprises the dissemination of acquired knowledge between different individuals or units within a company. This process is principally accomplished through informal interactions among the employees of the company (Koffman and Senge, 1993; Cabrera *et al.*, 2006). For this reason, relationships, integration and communication between members of an organization are crucial for the success of this process.

Once acquired, knowledge interpretation is required in order that information is understood and assimilated by employees in order to transform it into a new common knowledge (Daft and Weick, 1984). Again, human resources and the relationships between individuals them are key elements in the process.

Finally, in the last phase of KM, organizational memory, the new knowledge is stored in the organization for future use. Information technology (IT) is a key elements in information storage and retrieval (Huber, 1991) but is more useful for recording explicit knowledge than for tacit knowledge. This latter type of knowledge is embedded in work practices and is difficult to store through IT (Currie and Kerrin, 2003) because it is expressed as organizational routines (Cohen, 1991) and is retained through the memories and habits of the employees. Employees determine what information is going to be acquired and stored in the organizational memory (Walsh and Ungson, 1991); Huber (1991) suggests that relationships between employees govern the exchange of the stored information, and employee turnover can therefore adversely affect organizational memory.

Human resources thus play a key role in all aspects of KM processes (Nonaka and Takeuchi, 1995). Lang (2001) asserts that KM is based on individual learning of the company's members (Huber, 1991, Nonaka and Takeuchi, 1995) whereas Popadiuk and Choo (2006) suggest that relevant knowledge is based on human action, and this depends more upon the situation and people involved than on absolute truth or artifacts.

Because KM is crucially dependent on suitably motivated people who take an active role in KM processes, HRM practices are increasingly considered to constitute a key element of KM (Dodgson, 1993; Kamoche and Mueller, 1998; Chen and Huang, 2009; Minbaeva *et al.*, 2009) since HRM practices are the primary means by which firms can influence the skills, attitudes and behaviors of individuals (Chen and Huang, 2009). Thus, recent literature highlights that HRM practices could play an important role in facilitating employees' absorption, transfer, sharing and creation of knowledge within firms (Currie and Kerrin, 2003; Edvardsson, 2008; Chen and Huang, 2009; Minbaeva *et al.*, 2009).

HRM practices and knowledge management

HRM can enhance KM via two different routes. First, as mentioned above, organizations can use HRM practices to acquire and motivate employees with learning abilities. Second, HRM can develop an organizational culture that encourages the acquisition and transfer of knowledge (DeLong and Fahey, 2000; Edvardsson, 2008; Cabrera and Cabrera, 2005; Edvardsson, 2008).

Although the number of studies on the relation between HRM and KM have experienced an important increased in the last years, few studies have explored the impact of HRM practices on the whole KM process.

Some researches have used a case-study approach (Currie and Kerrin, 2003; Oltra, 2005; Grimshaw and Miozzo, 2009) whereas others have focused on specific KM processes and HRM practices. For example, Foss *et al.* (2009) focus on the relationship between job design and knowledge sharing. There are also some papers studying the effect of different HRM practices on knowledge sharing within the firm (Cabrera and Cabrera, 2005; Collins and Smith, 2006; Camelo-Ordaz *et al.*, 2011; Chen *et al.*, 2011; Liu and Liu, 2011). Recently, other researchers explored the relationship between HRM and innovation by addressing the effects of HRM on KM. That is to say, they suggest that KM mediates the relationship between HRM and innovation. These studies focus on some individual HRM (Chen and Huang, 2009) or on a HRM system (Lopez-Cabrales *et al.*, 2009).

The present paper adopts a broader perspective and aims to study the relations between HRM and the whole process of KM. We focus on different HRM practices both in isolation and forming a knowledge-oriented HR system.

We begin with the review of the literature addressing the relationship between HRM practices and KM. The purpose of this review is to identify which specific HRM practices should be adopted to enhance KM and why it is expected that they foster KM. We focus on job design practices, teamwork, staffing, career development, training, performance appraisal and compensation.

Regarding job design, we agree with Foss *et al.* (2009) that job design may impact employee motivations to share knowledge, but we suggest that it is also relevant for the other KM processes. Job design is known to affect employees motivation (Foss *et al.*, 2009, Gagné, 2009) and, therefore, their disposition to learn and to share their knowledge with their coworkers, that in turn will affect knowledge acquisition, distribution, interpretation and transformation into routines. All these processes will be enhanced by flexible organizational structures and broadly defined jobs (Kim, 1980; McGill and Slocum, 1993; Nonaka and Takeuchi, 1995; Lei *et al.*, 1999) because they encourage experimentation among employees (Leonard-Barton, 1992; Garvin, 1993; McGill and Slocum, 1993) Autonomy is also highly related to KM (Nonaka and Takeuchi, 1995; Foss *et al.*, 2009) and the study of Foss *et al.* (2009) provides evidence that autonomy increases employee intrinsic motivation to share knowledge. Employee participation in decision-making can also encourage the KM process (Dibella *et al.*, 1996; Chen and Huang, 2009). According to Chen and Huang (2009) when employees have more opportunities to provide inputs and determine the required actions, they may increase the diversity and richness of knowledge exchange, thereby facilitating the discovery and utilization of dispersed knowledge and expertise in the organization. Finally, internal communication is also considered to facilitate KM because it provides a rich medium for information sharing (Minbaeva, 2005; Liu and Liu, 2011). In sum, we propose the following hypothesis:

H1. The adoption of a knowledge-oriented job design will have a positive effect on the whole knowledge management process.

Because teamwork fosters communication and collaboration between employees, teamwork has been suggested to be a key element of KM (Senge, 1990; Lei *et al.*, 1999;

Cabrera and Cabrera, 2005; Chen *et al.*, 2011). Teamwork encourages people to share their ideas and knowledge openly with the other members of the group (Senge, 1990; Nonaka and Takeuchi, 1995; Lei *et al.*, 1999) and this facilitates the dissemination of individual knowledge throughout the organization (Lopez-Cabrales *et al.*, 2009). In this line, the study of Cabrera and Cabrera (2005) found a positive relationship between HRM practices orientated towards teamwork and the employees' willingness to share knowledge. Furthermore (Hansen, 1999), the literature maintains that cross-functional teams (Ulrich *et al.*, 1993; Snell *et al.*, 1996; Lei *et al.*, 1999; Cabrera and Cabrera, 2005) and autonomous work groups (Gagné, 2009) are also considered of especial benefit to KM. We thus expect:

H2. Teamwork will have a positive effect on the whole knowledge management process.

Although there is an agreement about the relevance of staffing on KM (Leonard-Barton, 1992), there are some contradictions in the literature regarding which hiring practices enhance it the most. For example, while some authors defend the use of internal recruitment, others have emphasized the importance of external recruitment. Internal recruitment offers stability and career opportunities within the company to its most qualified employees (Ulrich *et al.*, 1993; Nonaka and Takeuchi, 1995), increasing their commitment and thus facilitating the transfer of knowledge from individuals to companies. By contrast, according to Lepack and Snell (1999), internal recruitment could inhibit adaptation of the company to environmental changes and constrain the generation of new ideas. For this reason they suggest that external recruitment is preferable for introducing new knowledge into the company. In our opinion, internal recruitment is more consistent than external recruitment with other KM practices. Furthermore, internal recruitment can facilitate the development of an organizational learning culture: in other words, a culture characterized by openness to experience, encouragement of responsible risk-taking, and willingness to acknowledge failures and learn from them (McGill and Slocum, 1993). Because KM requires a learning-oriented culture (DeLong and Fahey, 2000; Cabrera and Cabrera, 2005), it is generally considered that employee selection should be based more on how well they fit within the culture of the organization (Leonard-Barton, 1992; Kristof, 1996; Cabrera and Cabrera, 2005), rather than on their fitness to perform a specific job (Leonard-Barton, 1992, Dibella *et al.*, 1996) or just for what they can do (Cabrera and Cabrera, 2005). The premise here is that congruence of individual and organizational values will facilitate sharing between employees (Cabrera and Cabrera, 2005; Gagné, 2009). Polyvalence is also suggested as a criterion for selecting people because it can foster individual learning as well as the distribution of new knowledge throughout the organization (McGill *et al.*, 1992; Garvin, 1993; Ulrich *et al.*, 1993; Nonaka and Takeuchi, 1995). Finally, employment security provides employees with stability and therefore generates a motivated and skilled human resource that in turn promotes learning (Nonaka and Takeuchi, 1995). Therefore, we hypothesize:

H3. The adoption of a knowledge-oriented staffing will have a positive effect on the whole knowledge management process.

Career development is also important regarding the KM processes. It has been proposed that KM can be enhanced by providing employees with internal career

opportunities because this stimulates employees to develop and apply their skills (Dodgson, 1991; Leonard-Barton, 1992), so enhancing individual learning. McGill *et al.* (1992) pointed out that promotions should increase the mobility of employees across divisions and functions, because this is likely to foster the acquisition and dissemination of new knowledge and the employee's polyvalence. Promotions should be based primarily on qualitative criteria such as adaptability to changes, creativity, and risk-taking or innovative behavior (McGill and Slocum, 1993; Ulrich *et al.*, 1993). Finally, employees must exert some control over their own careers and development and should be responsible for recognizing their own developmental needs (Garvin, 1993; Jaw and Liu, 2003). Thus, we propose:

H4. The adoption of a knowledge-oriented career development practices will have a positive effect on the whole knowledge management process.

Regarding training, some studies highlight the positive effect of training on KM because it plays a critical role in maintaining and developing individual capabilities and a learning-oriented organizational culture (Jerez-Gómez *et al.*, 2005; Chen and Huang, 2009; Liu and Liu, 2011). In general, literature points to the importance of a broad application of training in order to develop employees' learning capabilities and to provide a common language and shared vision which foster the transfer and dissemination of individual knowledge within the firm (McGill and Slocum, 1993; Ulrich *et al.*, 1993; Jerez-Gómez *et al.*, 2005; Cabrera and Cabrera, 2005). In this line, the study by Jerez-Gómez *et al.* (2005) provides evidence that ongoing training enhances organizational learning capability, both because it favors the acquisition and generation of new knowledge and skills and because it enhances knowledge transfer. Furthermore, training is considered to enable employees' skills to be translated into organizational routines (Kamoche and Mueller, 1998), and this also fosters the learning process. Another characteristic of training which is found to enhance KM is that it is long-term oriented, since it improves the adaptation and anticipation capacity the environment requires (Nevis *et al.*, 1995). In addition, literature suggests that multi-skill training is better than specific training to enhance learning (Leonard-Barton, 1992; Jerez-Gómez *et al.*, 2005; Cabrera and Cabrera, 2005) because the former has a positive impact on the degree of openness and acquisition of new knowledge and on the degree of knowledge transfer (Jerez-Gómez *et al.*, 2005). In this line, some studies suggest that companies could use internal job rotations (McGill *et al.*, 1992; Ulrich *et al.*, 1993; Ortega, 2001) to acquire polyvalence and to stimulate the dialogue among people from different levels of the company (Snell *et al.*, 1996) and Jerez-Gómez *et al.* (2005) found that the use of job rotation programs has a positive effect on two dimensions of organizational learning capability: learning commitment and system thinking. Finally, because teamwork is very important for KM, training should be designed with a group orientation (Garvin, 1993; Romme and Dillen, 1997; Cabrera and Cabrera, 2005). Accordingly, we expect:

H5. The adoption of a knowledge-oriented training will have a positive effect on the whole knowledge management process.

It has also been suggested that the used of systematic performance appraisals is particularly relevant for KM (McGill *et al.*, 1992; Ulrich *et al.*, 1993) since it usually includes performance feedback. Some authors highlight the importance of providing

the employees with feedback about their performance. According with Foss *et al.* (2009) an employee is motivated to share knowledge by feedback, and this can be encouraged as part of the evaluation process. A group orientation in performance appraisal is recommended (Leonard-Barton, 1992; McGill *et al.*, 1992; Dibella *et al.*, 1996) and is coherent with the importance of using teamwork for enhancing KM. On the other hand, because the acquisition and distribution of new knowledge requires some time before it can be translated into results, performance appraisals should be based on long-term results and be aimed at maximizing current and future development (Currie and Kerrin, 2003; Cabrera and Cabrera, 2005) rather than focusing on employee control (London and Smither, 1999; Cabrera and Cabrera, 2005). Finally, although appraisals should be performed by each employee's superior, it is important that the employee is actively involved in the whole process (Dodgson, 1991). Accordingly, we propose:

H6. The adoption of a knowledge-oriented performance appraisal will have a positive effect on the whole knowledge management process.

The literature also suggests that compensation should be linked to performance appraisal (McGill *et al.*, 1992) and include appropriate incentives to impact KM (McGill *et al.*, 1992; Leonard-Barton, 1992; Ulrich *et al.*, 1993; Hansen *et al.*, 1999; Jerez-Gómez *et al.*, 2005; Fey and Furu, 2008; Chen and Huang, 2009; Liu and Liu, 2011). These incentives should reward employees' contributions to knowledge creation and transfer (Garvin, 1993; Von Krogh, 1998; Simonin and Özsomer, 2009). Importantly, the provision of incentives should encourage experimentation and learning (Ulrich *et al.*, 1993). As a consequence, compensation should not be based exclusively on specific roles or job descriptions but instead on the employee's performance (e.g. Leonard-Barton, 1992; Von Krogh, 1998) and skills and behavior (McGill and Slocum, 1993; Lei *et al.*, 1999; Lepack and Snell, 1999). Furthermore, given the importance of teamwork, incentives should be based not only on individual performance but also on group performance (Nonaka and Takeuchi, 1995; Von Krogh, 1998; London and Smither, 1999; Camelo-Ordaz *et al.*, 2011). Incentives based on overall company performance are also considered to foster the sharing of learning, knowledge and insights by employees (O'Dell and Jackson Grayson, 1998; Lei *et al.*, 1999). In addition, companies should adopt long-term rewards policies because these promote personal flexibility (McGill *et al.*, 1992). For example, bonus or profit-sharing incentives can promote self-esteem and staff involvement, commitment and learning (Leonard-Barton, 1992; Liu and Liu, 2011). Finally, the use of intrinsic versus monetary rewards as a compensation mechanism is also considered to foster KM (McGill *et al.*, 1992). Thus:

H7. The adoption of a knowledge-oriented compensation will have a positive effect on the whole knowledge management process.

Despite the diversity of HRM practices discussed above, it has been argued that their benefits to KM are maximized when they are implemented, not in isolation, but jointly as a system of mutually reinforcing practices. Thus it, the impact of HRM practices on the degree of knowledge management is stronger when HRM practices are applied as a system of mutually reinforcing practices (Minbaeva, 2005). In this context, Laursen and Mahnke (2001) have shown that the adoption of different HRM systems can have synergistic effects on learning. From the foregoing we surmise that the implementation

of a HRM system that includes the above-mentioned HRM practices will maximize all KM processes. We therefore propose:

H8. The adoption of a knowledge-oriented HR system will have a positive effect on the whole knowledge management process.

Methodology

Study sample and data collection

The information for testing the hypotheses was collected in the framework of a wider research project financed by European founds. The sample was selected from the SABI database. This database is published by two private companies (INFORMA and Bureau Van Dyck) and includes financial data from Spanish and Portuguese companies. We focused on the firms located in the southeast of Spain with more than fifteen employees. The firms were selected to cover a wide range of industries. The final list included 1600 companies. The average size of the firms surveyed was 75.6 employees, and their average age was 20.9 years (more information in Table I).

Information was collected by completion of a structured questionnaire and personal interview with CEOs of the companies sampled. We sent a letter to the firms

	%
SIC code and sectors	
A. Agriculture, forestry, and fishing	0.8
B. Mining	0.3
C. Construction	4.2
D. Manufacturing	51.1
E. Transportation, communications, electric, gas, and sanitary service	6.6
F. Wholesale trade	21.2
G. Retail trade	5.5
H. Finance, insurance, and real estate	0.3
I. Services	9.7
International activity	
Export	17.5
Import	6.7
Import and export	20.5
No intern activity	55.3
Sales volume (mill. €)	
<1.5	28.8
1.5-3	21.0
3-4.5	12.6
4.5-6	9.0
>6	28.6
Number of employees	
<25	29.0
25-50	42.0
51-100	14.9
101-200	6.9
>201	7.2

Table I.
Sample characteristics

encouraging them to participate in the study. Then, a specialized company in surveys collected the data. A total of 706 CEOs were interviewed, face-to-face, along a period of three months. Using this method, we obtained 701 valid responses, yielding a response rate of 43.8 percent.

We compared respondent and non-respondent companies in terms of general characteristics and model variables. No significant differences were found between those two groups, suggesting that there was no response bias.

Measures

In order to test the hypotheses, we measured twelve variables: the 7 HRM practices we propose to affect KM, the knowledge-oriented HR system and the four processes of KM (acquisition, distribution, interpretation and memory). Table II provides an overview of the means and standard deviations of the measures and the correlations between them.

Knowledge-oriented HR practices. Drawing upon previous literature, respondents were asked to indicate the extent to which their firm adopted a series of HRM practices that the literature has identified as being likely to have a significant impact on KM processes. We used 34 items which cover the most important areas of HRM:

- *Job design*. Flexibility, broadly defined jobs, internal communication, employee autonomy and participation in decision making.
- *Teamwork*. Importance of teamwork in the firm, degree to which teams are multidisciplinary and autonomous.
- *Staffing*. The degree of use of internal recruitment, polyvalence and fit to the organizational culture as criteria for selecting people, and employment security.
- *Career development*. Degree in which the firm uses internal promotion, the extent to which career paths are based on qualitative criteria, and enhance mobility across divisions and functions, and whether promotions are based on employees' developmental needs.
- *Training*. How broadly training is applied, the extent to which it has a long-term and group orientation and tries to promote employee polyvalence, the use of internal job rotation and the degree of employee participation in training design.
- *Performance appraisal*. Whether it is systematic, the extent that it has a long-term and group orientation, is based on process, is directed towards employee development, provides feedback and enhances the participation of employees in the process.
- *Compensation*. The degree to which the company offers incentives, the extent to which compensation is based on employee competences, group and long-term performance, and includes non-monetary rewards, and the extent to which employee participation in the compensation design is fostered.

The seven HRM areas (job design, teamwork, staffing, career development, training, performance appraisals and compensation were measured using theoretically driven additive indexes. An additive index is made up of items that "determine the level of a construct," as opposed to a scale, which assumes that responses to items are "caused by an underlying construct" (DeVellis, 1991). Thus, additive indexes are formative rather that reflective. Additive indexes are the preferred method for creating a single measure from a series of underlying dimensions that can be cumulated to determine

Constructs	Mean	SD	Correlations											
			1	2	3	4	5	6	7	8	9	10	11	12
1. Job	3.215	0.804	1											
2. Teamwork	3.398	0.749	0.290	1										
3. Staffing	3.071	0.640	0.218	0.080	1									
4. Career Devel.	2.828	0.820	0.222	0.268	0.229	1								
5. Training	3.042	0.852	0.180	0.344	0.215	0.465	1							
6. Appraisal	3.035	0.700	0.192	0.281	0.108	0.351	0.430	1						
7. Compensation	2.254	0.759	0.039	0.137	0.093	0.268	0.331	0.337	1					
8. HR System	2.977	0.454	0.522	0.580	0.439	0.689	0.732	0.642	0.532	1				
9. Acquisition	3.456	0.865	0.116	0.159	0.134	0.318	0.315	0.286	0.137	0.356	1			
10. Distribution	2.834	0.934	0.147	0.186	0.176	0.317	0.274	0.267	0.187	0.375	0.443	1		
11. Interpretation	3.445	0.816	0.276	0.288	0.178	0.306	0.366	0.312	0.049	0.431	0.489	0.532	1	
12. O. Memory	3.578	1.069	0.057	0.109	0.156	0.304	0.241	0.128	−0.029	0.236	0.390	0.325	0.390	1

Table II.
Constructs correlation matrix

the level of the construct (Jason *et al.*, 2005) as it is the case of the HRM areas we aimed to measure. Working at the index, rather than practice, level is also consistent with considerable prior research on HRM (MacDuffie, 1995; Youndt *et al.*, 1996; Delery, 1998; Batt, 2002). Accordingly, for each HRM area we focused on it was generated an index, as the average of the items we used to measure them. Similarly, the knowledge-oriented HR system was measured as the average of the seven previously mentioned indexes.

It is important to note that reliability assessments that require strong internal consistency, such as coefficient alpha, are not appropriate with formative variables (MacKenzie *et al.*, 2005) because the measures of HRM are independent, and a change in one indicator does not necessarily imply changes in the other indicators (Rauch *et al.*, 2005).

Knowledge management. The four phases of the KM model were measured with 25 five-point Likert scales, using the scale of Perez Lopez *et al.* (2004). Table III shows the items included for the four subprocesses of the KM model: knowledge acquisition (scale composite reliability $\rho_c^{SCR} = 0.81$, average variance extracted $\rho_c^{AVE} = 0.61$), knowledge distribution ($\rho_c^{SCR} = 0.78$, $\rho_c^{AVE} = 0.54$), knowledge interpretation ($\rho_c^{SCR} = 0.79$, $\rho_c^{AVE} = 0.56$) and organizational memory ($\rho_c^{SCR} = 0.77$, $\rho_c^{AVE} = 0.53$). Following the model of Huber (1991), in the model we include the relations between these processes.

To assess the unidimensionality of each construct we conducted confirmatory factor analysis (Anderson and Gerbing, 1988) using EQS. The measurement model provides a reasonable fit to the data (see Table III). The traditionally reported fit indices are within the acceptable range. Furthermore, the GFI, CFI, BBNFI and IFI statistics exceed the recommended 0.90 threshold level. Although p values of the chi-square is significant, the relation between χ^2/d.f is below 3, what indicates a good fit for the hypothesized model (Jöreskog, 1978; Carmines and McIver, 1981). Reliability of these measures was calculated using Bagozzi and Yi's (1998) composite reliability index and Fornell and Lacker's (1981) average variance extracted index. For all the measures both indices are higher than the evaluation criteria of 0.6 for the composite reliability and 0.5 for the average variance extracted (Bagozzi and Yi, 1998). Furthermore, all items load on their hypothesized factors (see Table III), and the estimates are positive and significant (the lowest t-value is 16.66), providing evidence of convergent validity (Bagozzi and Yi, 1998). Discriminant validity is supported because the confidence interval (± 2 S.E.) around the estimated correlation between any pair of latent indicators did not include 1.0 (Anderson and Gerbing, 1988).

Analysis and results

We tested the hypotheses using the "structural equations modeling" (SEM) method. SEM allows testing in the same analysis of factor analysis and hypotheses. Thus, SEM techniques also provide fuller information about the extent to which the research model is supported by the data beyond the regression techniques (Bollen, 1989; Jöreskog and Sörbom, 1993). Testing employed conventional maximum likelihood estimation techniques (Jöreskog and Sörbom, 1993).

We tested two models. Both models, one including the seven HRM policies individually ($\chi^2_{(107)} = 294.822$; GFI = 0,955; RMSEA = 0,052; CFI = 0,955; IFI = 0,956; BBNFI = 0,923) and the model including them as a system ($\chi^2_{(78)} = 175{,}491$; GFI = 0,956; RMSEA = 0,059; CFI = 0,960; IFI = 0,960; BBNFI = 0,943) show satisfactory fits, thereby suggesting that the nomological

Item description	Standardized loading	Reliability (SCR[a], AVE[b])
Knowledge acquisition		
1. The company is in touch with external professionals and expert technicians	0.462	SCR = 0.81 AVE = 0.61
2. New ideas and approaches on work performance are experimented continuously	0.903	
3. Organizational systems and procedures support innovation	0.897	
(scale: 1 = totally disagree; 5 = totally agree)		
Knowledge distribution		
1. Company has formal mechanisms to guarantee the sharing of best practices among different fields of the activity	0.737	SCR = 0.78 AVE = 0.54
2. There are individuals within organization who take part in several teams or divisions and who also act as links among them	0.756	
3. There are individuals responsible for collecting, assembling and distributing employees' suggestions internally	0.714	
(scale: 1 = totally disagree; 5 = totally agree)		
Knowledge interpretation		
1. All organization members share the same aim to which they feel committed	0.822	SCR = 0.79 AVE = 0.56
2. Employees share knowledge and experiences by talking to each other	0.775	
3. The company offers the opportunity to learn (visits to other parts of the organization, internal training programs,...) so as to make individuals aware of other departments' duties	0.644	
(scale: 1 = totally disagree; 5 = totally agree)		
Organizational memory		
1. The company has databases to stock its experiences and knowledge so as to be able to use them later on	0.757	SCR = 0.77 AVE = 0.53
2. Company has directories or e-mails filed according to the field employees belong to, so as to find an expert on a concrete issue at any time	0.751	
3. Company has up-to-date databases of its clients	0.684	
(scale: 1 = totally disagree; 5 = totally agree)		

Notes: Fit statistics for measurement model of 12 indicators for four constructs: $\chi^2_{(48)}=117.787$; GFI=0.970; RMSEA=0.047; CFI=0.978; IFI=0.978; BBNFI=0.964; [a]Scale composite reliability ($\rho_c=(\Sigma\lambda_i)^2\text{var}\ (\xi)/[(\Sigma\lambda_i)^2\text{var}\ (\xi)+\Sigma\theta_{ii}]$ (Bagozzi and Yi, 1998)); [b]Average variance extracted ($\rho_c=(\Sigma\lambda_i^2\text{var}\ (\xi))/[\Sigma\lambda_i^2\text{var}\ (\xi)+\Sigma\theta_{ii}]$ (Fornell and Larcker, 1981))

Table III.
Construct measurement summary: confirmatory factor analysis and scale reliability

network of relationships fits our data. This is a further indicator of support for the validity of these scales.

In terms of our hypothesis (Table IV), the findings show that HRM practices we have proposed to be knowledge-oriented practices affect KM but not all the phases it comprises. Furthermore, they do not always affect KM with the proposed sing.

Predictor	*H1*: Knowledge acquisition	*H2*: Knowledge distribution	*H3*: Knowledge interpretation	*H4*: Organizational memory
Individual HRM relationships model				
Job design	0.037*	0.012*	0.163***	−0.138***
Teamwork	−0.004*	0.078**	0.038*	−0.018
Staffing	0.059*	0.080**	0.016*	0.044*
Career development	0.203***	0.105**	−0.020*	0.236***
Training	0.159***	0.015*	0.174***	0.081*
Performance appraisal	0.166***	0.069*	0.074**	−0.043
Compensation	−0.015*	0.080**	−0.174***	−0.122***
Knowledge acquisition		0.473***		
Knowledge distribution			0.669***	
Knowledge Interpretation				0.435***
System HRM relationships model				
Knowledge-oriented HR system	0.400***	0.256***	0.180***	0.065*
Knowledge acquisition		0.477***		
Knowledge distribution			0.671***	
Knowledge interpretation				0.450***

Notes: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Table IV.
Construct structural model

For instance, the job design we proposed as being knowledge-oriented is not related either with knowledge acquisition either with knowledge distribution (since β are not significant for these two KM processes). In addition, although, as predicted, it is positively associated to knowledge interpretation, its relation with organizational memory is negative. Therefore, these results do not provide evidence for *H1* (knowledge-oriented job design → KM). Regarding *H2* (teamwork → KM), findings provide evidence that teamwork enhances knowledge distribution but this practice does not affect the other KM phases.

H3 to H6 are partially supported by our findings. As Table III shows, staffing (*H3*) has a positive effect on knowledge acquisition and distribution but its effect on knowledge interpretation and organizational memory is not significant. Career development (*H4*) affects all the KM phases with the predicted sign with the exception of knowledge interpretation. Training (*H5*) is found to affect three of the four phases of the KM process: knowledge acquisition, knowledge interpretation and organizational memory. Performance appraisal (*H6*) does have a positive effect on all the KM process with the exception of organizational memory.

Results for compensation (*H7*) are contrary to our expectations because, although it has a positive effect on knowledge distribution, it has a negative effect on both knowledge interpretation and organizational memory. No significant results were found regarding knowledge acquisition.

In sum, our findings regarding the effect of isolated HRM practices on KM process are mixed. However, we found strong support for the relation between the adoption of a knowledge-oriented HR system and KM process and, therefore, to the *H8*. According to

our findings, this system has a positive effect on the four phases comprising the KM process. That is to say, data indicates that the adoption of a knowledge-oriented HR system contributes to the establishment of mechanisms that allow acquiring, distributing, interpreting and storing the knowledge in organizations.

In order to analyze the relations between HRM and KM more in depth, we conducted additional analyses. In particular we explored the variations in the strengths of the relationship between each HRM practice and the different KM processes. We focused on the differences between significant parameters. For instance, we analyzed whether the effect of job design on knowledge interpretation and the effect of the former on organizational memory are significantly different or not. For testing this, we used the chi-square difference test (Anderson and Gerbing, 1988) between a constrained model, where the correlation of a pair of parameters was fixed to unity (that means that we test our model with the condition, for instance, that the effect of job design over knowledge interpretation, and the effect of job design over organizational memory is the same) and an unconstrained model where the correlations are freely estimated (the original model which results are in Table IV). Significant changes in the fit of the model thought chi-square test would show a worse fit of the model, meaning that both parameters are significant different.

These additional analyses show that there is a significant difference in the effect of job design on knowledge interpretation and the effect of job design on organizational memory. Taking into account the β parameter of both relationship (Table IV), this means the effect of job design on knowledge interpretation ($\beta = 0.163$) is significantly higher that the effect of this HRM practices on organizational memory ($\beta = 0.138$). Regarding, staffing, we did not find any significant difference between the β for the relationship between staffing and knowledge acquisition and the β for the relationship between staffing and knowledge distribution. Thus, we can assume that staffing influence with the same strength to both KM processes. Similar results where obtained for training, thus we conclude that the impact of this practice on knowledge acquisition, interpretation and organizational memory has de same strength. Regarding career development, findings showed that its positive effect on organizational memory is higher that its effect on both, knowledge acquisition and knowledge distribution. The only different we found for the B parameters between performance appraisal and the knowledge processes is between knowledge distribution and knowledge interpretation.

Findings for compensation showed the impact of this practice on knowledge distribution is significantly different to the impact of this practice on both knowledge interpretation and organizational memory and that the negative effect of compensation on the later two KM processes is of the same strength.

Finally, although the HRM system is positively related with the four KM processes, its effect on both knowledge acquisition and distribution is higher that its effect on knowledge interpretation and organizational memory.

Therefore, these additional analyses indicate that HRM practices affect the KM processes and that its effect is higher when the company adopts a system of internally consistent practices than when these practices are adopted in isolation. However, findings also revels that not all the HRM practices that, according to the literature, are expected to enhance KM do impact KM. Furthermore, our results show that there is a variation in the strength of the relationship between some HRM practices and the different KM processes we have studied.

Discussion

The important role of human resources, and therefore of HRM, in enhancing KM has been widely debated in the literature. However, the empirical research on this field is still scarce and, more importantly, as Minbaeva *et al.* (2009) posits, there is also a lack of research into the HRM practices that are relevant for knowledge processes. The purpose of this study was to examine the relationship between HRM and KM from a broader perspective, focusing on HRM practices both in isolation and forming a knowledge-oriented HR system, and exploring the relationship between them and the phases comprising the KM process: knowledge acquisition, knowledge distribution, knowledge interpretation and knowledge storing (organizational memory).

From literature review, we have identified the HRM practices which may be considered to be knowledge-oriented practices and have examined why they are expected to affect KM. In general, the reason is that they provide employees with learning capabilities, they increase their commitment with the organization and they increase their willingness to relate with coworkers and share their knowledge with them.

The second contribution of this paper resides in the fact that it provides evidence of a positive relation between the adoption of knowledge-oriented HR practices and KM. Findings show that the adoption of a knowledge-oriented HR system is positively associated to the four KM processes. These results are consistent with previous literature suggesting that HRM plays a crucial role in the process of knowledge acquisition (Ulrich *et al.*, 1993; Kim, 1998; Lopez-Cabrales *et al.*, 2009). Our results also support previous literature focusing on the relationship between knowledge transfer or sharing and HRM (Cabrera and Cabrera, 2005; Minbaeva, 2005; Collins and Smith, 2006; Camelo-Ordaz *et al.*, 2011; Chen *et al.*, 2011). The adoption of a knowledge-oriented HR system was found to enhance both knowledge dissemination and knowledge interpretation. The extant literature maintains that these processes are highly dependent on interaction and communication between organization members and their motivation to share their individual knowledge. The measure of knowledge-oriented HR system we have adopted include practices oriented to enhance interactions among employees and their motivation to share knowledge. Our findings therefore provide support for the premise that employee motivation and interactions directly affects knowledge sharing. Finally, we also found that the adoption of a knowledge-oriented HR system can have a significant positive impact on organizational memory. The effect is smaller than the effect of such a HRM system on knowledge acquisition, dissemination and interpretation, but is also positive. This may mean that, although HRM practices are crucial for increasing the knowledge stored by the firm (Walsh and Ungson, 1991), other mechanisms, including IT, are likely to be relevant to this process.

Although findings provide strong support for a positive relation between the adoption of a knowledge oriented HRM system and the four KM processes, our results regarding the relation between individual HRM practices and KM are not always as expected. In particular, we did not found any significant relation between some HRM practices and some KM process. For instance, what we named a knowledge-oriented job design was not found to affect neither knowledge acquisition nor knowledge distribution (although it does affect knowledge interpretation and organizational memory, as predicted). Furthermore, contrary to our expectations, compensation had a

negative effect on two of the four process of KM: knowledge interpretation and organizational memory.

Focusing now on each of the four KM processes analyzed, some conclusions derive from our findings. First, that staffing, career development, training and performance appraisal are key practices for enhancing knowledge acquisition. Second, that the HRM practices which are crucial for knowledge distribution are teamwork, staffing, career development, performance appraisal and compensation. Third, that knowledge interpretation is only affected by job design, training, performance appraisal and compensation (in this case, with negative sign). Finally, that job design, career development, training and compensation (this one with negative sign) are the HRM practices affecting knowledge storing or organizational memory. A likely explanation of these results may be in organizational dilemma of knowledge exploitation and exploration (Edvardsson, 2008; Lopez-Cabrales *et al.*, 2009). That is to say, it is possible that HRM practices that promote the generation of new knowledge (exploration) make difficult the exploitation and store of that knowledge. Regarding organizational memory, in general our findings show that the effect of HRM on this process is lower that the effect of the former on the other KM process. This may be due to the fact that this process is also based on technical aspects, such as, databases and systems.

In sum, our findings show that the relation between HRM and KM does exist and that a knowledge-oriented HR system may enhance all the KM processes. In addition, our findings highlight the importance of adopting knowledge-oriented HR practices not in an isolated manner but forming a system of consistent HRM practices, since individual HRM does not affect all the KM processes but when they are adopted together, as a system, they foster knowledge acquisition, distribution, interpretation and storing.

The implications of these findings for practitioners are clear. An organization hoping to enhance the creation and development of organizational knowledge should pay attention to its HRM practices. In particular, the organization should emphasize the implementation of HRM systems that enhance individual learning and the motivation for sharing and transfer knowledge within the firm. Although more research is needed to define completely which HRM practices should include this knowledge-oriented HR system, according to our findings, training, performance appraisals and career development are particularly relevant as they were found to affect most of the KM processes. Regarding training, our results suggest the broad application of training, which is long-term and group oriented and which tries to provide employees with polyvalence, for instance by the use of internal job rotation. Findings also suggest the use of performance appraisal, also with a long-term and group orientation, with a developmental purpose (instead of control) and which includes feedback. Finally, our results show that KM requires that the company offers broad and planned career paths, enhances the mobility of employees across divisions and functions and bases promotions on qualitative criteria such as adaptability to changes, creativity, and risk-taking.

Despise the contributions of this paper its results should not be interpreted without recognizing the potential limitations of the study. First, all the study data were collected using a single recording method. Therefore, the results could be affected by common method variance (CMV). Second, as discussed earlier, the study employed a cross-sectional design that can constrain both the observation of multiple long-term

effects of each variable and the elucidation of causal relationships between the variables. These two limitations could be avoided by employing a longitudinal study design. Third, this paper is based on Huber's framework of organizational learning, that is to say, we adopt a managerial approach to study the knowledge management process, ignoring developments on the social and political aspects of both organizational learning and knowledge management since the 1990s. Future research would enrich adding these approaches.

Other recommendations for future research on the relationship between HRM and KM emerge from the present study. First, since our findings reveals that the effect of HRM practices on each phase of the KM process may be different, we suggest studying more in depth the relationships between each HRM practice we have included in the knowledge-oriented HR system and each of the four phases of the KM process. Second, we suggest that both organizational culture and employee behavior are likely to modulate the relationship between HRM practices and each of the KM processes. Our premise in proposing that HRM affects KM is that HRM could enhance employees' abilities and motivation to learn as well as foster the creation of a learning-oriented culture. However, these variables were not included in the present analysis. The need for further research on these specific factors accords with the suggestions of Minbaeva *et al.* (2009) regarding the need to study "the underlying mechanisms by which HR practices influence the development of knowledge". The study of Camelo-Ordaz *et al.* (2011) adopts this approach. In particular, it provides evidence that employee commitment mediates the relationship between HRM practices and KM sharing. Finally, because the nature of knowledge can have an impact upon how it is shared between employees (Currie and Kerrin, 2003), we consider that it would be interesting to study whether different KM strategies, in particular personalization and codification (Hansen *et al.*, 1999, Edvardsson, 2008), require different HRM practices.

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