



## Article

# The mediating effect of strategic human resource practices on knowledge management and firm performance



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## ABSTRACT

Previous empirical evidence has suggested that knowledge management and human resource practices can interact in order to improve firm performance. Based on this idea, the purpose of this study is to propose and test an integrative model that examines strategic human resource practices as a catalytic mechanism influencing the effectiveness of knowledge management. Our findings confirm that knowledge management strategies positively influence firm performance through certain high work performance practices – selective staffing, intensive training, active participation, comprehensive performance appraisal, and performance-based compensation – highlighting the mediating role of human resource management in this relationship and the need to align human resource practices with organizational strategies.

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## Gestión del conocimiento y resultados empresariales: efecto mediador de las prácticas de recursos humanos

## RESUMEN

La evidencia empírica previa señala que tanto la gestión del conocimiento como las prácticas de recursos humanos pueden interactuar de diversas formas para mejorar los resultados de la empresa. Partiendo de esta idea, el objetivo de este trabajo es proponer y contrastar un modelo que examina la gestión de recursos humanos como mecanismo catalizador de la efectividad de la gestión del conocimiento. Nuestros hallazgos confirman que las estrategias de codificación y personalización del conocimiento influyen positivamente en los resultados de la empresa a través de determinadas prácticas estratégicas de recursos humanos de alto rendimiento, lo que confirma el papel mediador de la gestión de recursos humanos en dicha relación y la necesidad de ajustar las prácticas de recursos humanos a las características estratégicas de la organización.

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## Introduction

Today most of the companies operate in complex and dynamic environments, where competition is constantly increasing and, therefore, the traditional sources of competitive advantage do not

guarantee the survival of the organization, creating a need for rapid adaptation. This situation is leading to a redefinition of business strategies (Pfeffer, 1994; Wernerfelt, 1984). There is much debate about the need to pay greater attention to strategic resources and how they are managed, especially those capable of providing economic value and competitiveness for companies. Barney (1991) argues that intangible resources can become a source of sustainable competitive advantage to meet the requirements of value and inimitability (Barney, 1991; Black & Boal, 1994). In this sense, knowledge and human capital are important assets for organizations and an

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effective management of those assets can make possible for companies to leverage the knowledge and skills of employees while developing human resource management models tailored to the needs the environment, contributing to the improvement of firm performance (Soliman & Spooner, 2000; Yahya & Goh, 2002).

While some studies have noted that knowledge management promotes firm performance (Chen & Huang, 2009; Hsiao, Chen, & Chang, 2011; López-Nicolás & Meroño-Cerdán, 2011; Palacios & Garrigós, 2006; Rašula, Bosilj Vukšić, & Indihar Štemberger, 2012), others studies argue that it is human resource management that helps to improve this performance (Becker & Gerhart, 1996; Chen & Huang, 2009; Collins & Clark, 2003; Huselid, 1995; Youndt, Snell, Dean, & Lepak, 1996). In addition, some research suggests that knowledge management and human resource management are closely related (Afouni, 2007; Haesli & Boxall, 2005; Oltra, 2005; Theriou & Chatzoglou, 2008; Wang, Chiang, & Tung, 2012). The majority of these studies opt for analyzing the mediating effect of knowledge management in the relationship between human resource management and firm performance (Jackson, Schuler, & Jiang, 2014).

Surprisingly, few studies have suggested an inverse relationship between these concepts, which might be expected considering the potential strong interaction between knowledge management and human resource management (Chuang, Jackson, & Jiang, 2013; Liao, 2011; Shih & Chiang, 2005). Therefore, the main objective of this work is offering a different perspective on the role human resource management, responding also to recent calls for alternative causal models to analyze the catalytic or mediating role of human resources management in the relationship between knowledge management and firm performance (Jackson et al., 2014; Jiang, Takeuchi, & Lepak, 2013). This new perspective is important to the extent that it can determine whether certain systems of human resource management are able to translate organizational needs and strategies into a package of strategic human resource practices that can foster alignment of employee behaviors, thereby producing better outcomes for the organization (Jiang et al., 2013). Thus, recognizing the need for empirical studies to analyze the role of human resource management systems as catalytic mechanisms in developing organizational strategies and goals (Jiang et al., 2013), we examine the mediating effects of certain strategic high performance work practices in the areas of staffing, training, participation, performance appraisal and compensation (Chen & Huang, 2009; Huselid, 1995). It is expected that these practices can mediate the relationship between knowledge management – measured through codification and personalization strategies – and firm performance. The relationships are examined using structural equation modeling methodology in a sample of 191 Spanish industrial companies.

The specific contributions of this study can be summarized in three parts. First, it extends the limited literature that recognizes the need for alignment of the human resource management strategies as a mediator of knowledge management for the company that links the goals of the company and its improved performance (Jiang et al., 2013; Wang et al., 2012). Second, it supports the idea that managing the knowledge employees, through strategic human resource practices, is essential for organizations to maximize their performance (Chuang et al., 2013; Liao, 2011). Finally, it helps to explain the relationships between certain specific strategies of knowledge management and the high performance work systems, from the perspective that they contribute to firm performance (Chen & Huang, 2009; Snell & Youndt, 1995).

The work is divided into four sections. First, theoretical and empirical contributions related to the relationships between the variables that are included in the research model are reviewed. Second, methodology employed to test the model is described. Third, results are presented, ending with conclusions and discussion of

the results obtained. This final section also highlights the main implications for future research.

## Research background and hypotheses

### *Knowledge management and firm performance*

Knowledge can be defined as information combined with experience, context, interpretation and reflection (Davenport & Völpel, 2001). Knowledge is considered a valuable resource for organizations when it is incorporated in human capital, allowing companies to improve their distinctive competencies (Grant, 1996; Hansen, 1999; Spender, 1996). Although literature includes numerous types of organizational knowledge, the most frequently used framework is that which distinguishes between tacit and explicit knowledge (Afouni, 2007; Hussi, 2004; Polanyi, 1966; Spender, 1996). While codified or explicit knowledge is transmitted through formal and systematic language, and may take the form of software, patents, diagrams and the like, tacit knowledge is acquired through experience and resides in the human mind. That is, tacit knowledge is situational and subjective nature and thus it is difficult to formalize, to communicate and share with others (Martensson, 2000; Polanyi, 1966). It should be noted that much organizational knowledge is tacit, and it is considered an important source of competitive advantage (Ambrosini & Bowman, 2001). There are two basic strategies for knowledge management: a codification strategy based on explicit knowledge, and a personalization strategy based on tacit knowledge (Choi & Lee, 2003; Hansen, Nohria, & Tierney, 1999). Codification extracts knowledge from people and stores it with the help of technological systems for re-use. Personalization emphasizes dialog and personal contact to share and manage knowledge (Hansen et al., 1999). However, these two strategies are not mutually exclusive, and may function together in some combination (Hussi, 2004). Thus, from the point of view of business effectiveness, knowledge, both tacit and explicit, is recognized as a key resource that can produce competitive advantage if it is managed properly (Wang et al., 2012). Nonaka and Takeuchi (1995) view knowledge management as a tool that allows the company to emphasize and promote the productivity, flexibility and creativity needed to increase its value and competitiveness (Davenport & Völpel, 2001; Salojärvi, Furu, & Sveiby, 2005).

Research on how and under what circumstances the various knowledge management strategies lead to better outcomes has provided ample evidence that generally support the positive relationship between the knowledge management and firm performance (Yang, 2010). For example, López-Nicolás and Meroño-Cerdán (2011) show that the two knowledge management strategies of codification and personalization are mechanisms through which companies manage to achieve greater effectiveness and performance. Adopting a broader approach, Palacios and Garrigós (2006) find that six knowledge management practices – knowledge; learning; organizational understanding; innovative culture; individualized approach and skills – have a positive and significant effect on firm performance. Chen and Huang (2009), taking a more holistic approach, notice that the implementation of knowledge management systems has a positive and significant influence on the financial and operational performance of organizations. Also, the study of Hsiao et al. (2011) show that the capacity to manage the acquisition and dissemination of knowledge are positively related to the firm's performance, and point out that social interaction increases the strength of the relationship between knowledge management skills and performance. Finally, Rašula et al., 2012 show that the four strategies of creation, accumulation, organization and use of knowledge have a positive impact on company performance.

Other studies found no positive evidence in this regard, usually explaining this result by pointing to a lack of a proper implementation strategy and interaction between the various dimensions of knowledge. Yet ultimately there is a recognition that there is a clear theoretical and empirical foundation for the belief that knowledge management is influential in obtaining superior firm performance (Darroch, 2005; Mills & Smith, 2011; Seleim & Khalil, 2007). Therefore, it can be concluded that the literature largely supports the idea, based on the resource-based view, that properly implemented knowledge management, and the related interactions and complementarities between the strategies of codification and personalization, can contribute positively to firm performance. Therefore, the first research hypothesis proposed in the following terms:

**H<sub>1</sub>.** Knowledge management – through the implementation of codification strategies and personalization strategies – has a positive effect on firm performance.

#### *Strategic human resources practices and firm performance*

In complex and dynamic business environments like today's, effective management of human capital is increasingly important, being the foundation for much of the sustainable competitive advantage of a company (Barney, 1991; Wernerfelt, 1984). In this sense, human resource management is essential as a structural mechanism in the development and adaptation of human capital to achieve sustainable competitive advantage (Collins & Clark, 2003; Jackson et al., 2014). Through human resource practices, companies can influence and shape the skills, attitudes and behaviors of individuals, so that they can do their job better and achieve the objectives of the organization (Delery & Doty, 1996; Collins & Clark, 2003).

In fact, numerous studies have shown that certain human resource practices, either individually or as a system, can directly and positively affect the individual and collective outcomes of the company (Becker and Gerhart, 1996; Jiang et al., 2013). Thus, empirical studies have made considerable efforts to link sets of human resource practices to business outcomes, whether through so-called high performance work systems (Becker & Huselid, 1998; Delaney & Huselid, 1996; Huselid, 1995), based on trust (Arthur, 1994), through high engagement (Batt, 2002; Guthrie, 2001), or innovative practices (Ichniowski, Shaw, & Prenzushi, 1997; MacDuffie, 1995; Youndt et al., 1996), at the level of individual business units (Koch & McGrath, 1996), and in terms of the global financial and economic performance of companies (Becker & Huselid, 1998; Delaney & Huselid, 1996; Huselid, 1995). The common thread in these investigations is the idea that certain human resource practices can influence firm performance through their influence on the behavior of employees. Those employees are affected positively in their performance, and this improves individual and/or group productivity (Becker & Huselid, 1998; Guest, 1997). Although there are some studies that did not fully confirm the positive relationship (Guest, Michie, Conway, & Sheehan, 2003), their findings continue to be consistent with the main idea that strategic human resource practices influence employee behavior and generate positive effects in individual performance and therefore collective enterprise-level performance (Jackson et al., 2014).

Specifically, Huselid (1995, 635) describes high performance work practices, which “can improve the knowledge, skills, and abilities of a firm's current and potential employees, increase their motivation, reduce shirking, and enhance retention of quality employees”, thereby improving individual and organizational performance (Arthur, 1994; Becker & Gerhart, 1996; Ichniowski et al., 1997; Jiang et al., 2013; Youndt et al., 1996). It is therefore possible to refer to strategic human resource practices (Chen & Huang,

2009), to the extent that they enhance the ability and involvement of employees, encourage their commitment and encourage their efforts, providing scope for the organization to be proactive and more closely linked with learning, innovation and knowledge (Chen & Huang, 2009; Jackson et al., 2014). In this sense, it has been shown that selective selection, intensive training, encouraging active employee participation, conducting thorough performance assessment and establishing incentives linked to performance are high performance work practices that are related, through their impact on the development and motivation of employees, with better firm performance (Jackson et al., 2014; Jiang et al., 2013). These are therefore strategic human resource practices, to the extent that they promote inimitable attributes in employees that contribute to the achievement and maintenance of a sustainable competitive advantage for the organization (Chen & Huang, 2009; Collins & Clark, 2003; Guest, 1997; Huselid, 1995; MacDuffie, 1995; Youndt et al., 1996).

Therefore, considering the above arguments, it is expected that the extent to which human resource practices are strategically oriented toward high performance work practices (selective staffing, intensive training, active employee involvement, a comprehensive performance assessment, and incentive systems linked to performance), employees will be encouraged in the behaviors and attitudes that promote better individual and organizational performance. Thus, the second hypothesis is proposed as follows:

**H<sub>2</sub>.** Strategic human resource practices – selective staffing, intensive training, active participation, comprehensive performance appraisal, and performance-based compensation – have a positive effect on firm performance.

#### *The mediating effect of strategic human resource practices*

Much of the original literature on knowledge management focused on technological issues, but over time the human dimension has become more important to the extent that it has been discovered that technology alone is not as effective as expected (Afiouni, 2007; Haesli & Boxall, 2005). In this sense, Theriou & Chatzoglou (2008) note that although technology is necessary, it is not sufficient alone to ensure knowledge management and its relationship with human resource management. If the human resource management is about the effective management of people, and the most valuable resource of individuals is knowledge, then, human resource management and knowledge management must be closely related, as they share some activities and objectives and both focus on people (Oltra, 2005; Svetlik & Stavrou-Costea, 2007).

Davenport and Völpel (2001) summarize the situation by stating that knowledge management manages people, and vice versa. Scholl, Koenig, Meyer, & Heisig (2004) explain that the most effective method for knowledge management is an approach that combines different disciplines. According to their research, the most urgent and difficult aspect for understanding and advancing knowledge management is to give priority to human factors. Chuang et al. (2013) and Yahya and Goh (2002) note that human resource practices should be used to monitor, measure and intervene in the construction, personalization, dissemination and use of knowledge of employees. That is, the organization must use human resource management to increase the knowledge, skills, experience and creativity of all its employees (Soliman and Spooner, 2000; Wang et al., 2012). In this sense, the knowledge management strategy can be a key factor to consider when establishing the objectives of enterprise-level strategic human resource practices (Liao, 2011; Chuang et al., 2013).

In this vein, some researchers have begun to conceptualize human resource management and the orientation of human resource practices from the point of view of the objectives of

the organization and its knowledge strategy (Chuang et al., 2013; Jiang et al., 2013). These strategic human resource practices reflect (mediate) the demands of the organization and provide mechanisms to strengthen the required outcomes of employees as well as to support them in their work (Jiang et al., 2013). For example, when a company has a knowledge management strategy, whether it depends on codification or on personalization, strategic human resource practices are clearly oriented toward a high performance work system (Chuang et al., 2013; Huselid, 1995; Snell & Youndt, 1995). Specifically, emphasis on thorough recruitment and selection of employees who can solve problems, tolerate ambiguity, and are willing to share their knowledge and experience, is extremely important and will help employees to engage with the development of a knowledge management system. The organization may, after a thorough assessment of employees' skills, train them intensively and extensively according to the specific needs of the individual and overall company goals, using compensations packages to encourage employees to share their tacit and explicit knowledge (Wang et al., 2012).

Liao (2011) and Chuang et al. (2013) argue that, although companies can use interconnected personalization and/or codification strategies, global knowledge management strategies always require the development and implementation of strategic human resource practices (aimed at high-performance systems) covering aspects of selective selection, intensive training, active participation, performance evaluation and incentive-based compensation. If such strategic human practices are designed and properly oriented, knowledge management will help the company to maintain its competitive advantage, contributing to the improvement of firm performance (Chuang et al., 2013; Meso & Smith, 2000; Shih & Chiang, 2005). So, it is expected that the implementation of strategic human resource practices will facilitate knowledge management, and act as a catalyst in the relationship between knowledge management and firm performance. The third hypothesis is, therefore, proposed as follows:

**H<sub>3</sub>.** Strategic human resource practices mediate the relationship between knowledge management and firm performance.

## Methodology

### Population, sample and data collection

Data were collected from Spanish companies. The initial population, selected from the SABI database, was 4112 companies, which employed between 25 and 249 workers, from all industrial sectors. A telephone survey of this population was conducted between 1 December, 2011 and 18 January, 2012 based on a structured questionnaire. Information was obtained from 191 companies out of a total of 2251 companies contacted, representing a response rate of 8.48%. Smaller businesses were excluded due to poor formalization of knowledge management strategies and human resource practices. Similarly, we excluded larger enterprises because there are important differences regarding the management of human resources in small and medium sized enterprises, which could distort the empirical analysis. Finally, it should be noted that the survey was addressed to the chief executive officer of the company,<sup>1</sup> as it was considered that his/her position ensures a

<sup>1</sup> In order to minimize the risk of common method bias arising from taking information from only one source, this study uses data from two sources: the telephone interview for measures of knowledge management and human resource practices and the SABI database for measures of firm performance. In addition, as recommended by Podsakoff et al. (2003, 2012), we have tested for the absence of a single common factor that has an eigenvalue of greater than one. A poor fit of the single factor model is an indication that common method variance is not a major

**Table 1**  
Manufacturing sub-sectors.

Industries	CNAE 2009	N	%
Meat products, beverages, food and tobacco	10, 11, 12	21	11.62%
Textile, leather products and footwear	13, 14, 15	5	2.53%
Paper products, printing and publishing, lumber and wood	16, 17, 18	22	11.11%
Chemical products, rubber and miscellaneous plastics products and fuels	19, 20, 22, 23	46	23.74%
Primary metal industries, fabricated metal products	24, 25	26	14.65%
Electrical equipment, computer and optical industry	26, 27	7	3.54%
Industrial machinery and equipment, motor vehicles	28, 29, 30	19	9.60%
Other industries	21, 31, 32, 33, 35, 36, 37, 38, 39	45	23.23%
<b>Total</b>		<b>191</b>	

thorough understanding of the organization, its human resources practices and knowledge management strategies. The overall sampling error is 6.8%, for a confidence level of 95.5%<sup>2</sup> and  $p = q = 0.5$ . The distribution of the sample is represented by sectors in Table 1.

### Variables and measures

#### Strategic human resource practices

Measuring the set strategic human resource practices was based on a multidimensional scale drawn from the literature on high performance work practices provided by Huselid (1995), MacDuffie (1995), Youndt et al. (1996), Collins and Clark (2003) and Chen and Huang (2009). Specifically, we applied the model of Chen and Huang (2009), who measured five dimensions of human resource practices related to the staffing, training, participation, performance appraisal and compensation, using 15 items formulated on a 5-point Likert scale (see Appendix II). As the items are defined, scores closer to 5 indicate that the company is implementing a high performance work practice, as it places more emphasis on selective selection, intensive training, encouraging active employee participation, making a comprehensive evaluation of performance and establishing incentive systems linked to performance. The scale for staffing has a reliability ( $\rho_c$ ) of 0.849 and the average variance extracted (ave) is 0.652, values which conform to those recommended in the literature (Bagozzi & Yi, 1988, 2012). Similarly, for training the values ( $\rho_c = 0.843$  and ave = 0.642), for participation ( $\rho_c = 0.880$  and ave = 0.711), for performance appraisal ( $\rho_c = 0.834$  and ave = 0.623), and for compensation ( $\rho_c = 0.815$  and ave = 0.597).

#### Knowledge management

Knowledge management was measured using an adaptation of the scale developed by Choi and Lee (2003), in which the two strategies, codification and personalization, are dimensions. These scales have subsequently been used and validated in other studies, such

problem. The single factor model has a  $\chi^2 = 1241.26$  with 252° of freedom (NFI = 0.473; NNFI = 0.479; CFI = 0.524; IFI = 0.530; RMSEA = 0.142), which is much worse than the measurement model ( $\chi^2 (224) = 288.74$  ( $p = 0.002$ ), NFI = 0.90, NNFI = 0.96, CFI = 0.97, IFI = 0.98, RMSEA = 0.04) (see Appendix II for details) which suggests that common method bias is not a potential problem in the data collection.

<sup>2</sup> There are no statistically significant differences between the companies in the population and those in the sample on any of the key variables, including total investment, total turnover, return on sales, return on assets or return on investment, which is to say there is no evidence of a selection bias in the sample.

**Table 2**  
Means, standard deviations, correlations, and discriminant validity.

Variables	Mean	S.D.	1	2	3	4	5	6	7	8
1. Firm Performance	2.38	7.11	0.844							
2. Staffing	9.64	1.76	0.179**	0.807						
3. Training	8.95	2.24	0.275***	0.623***	0.801					
4. Participation	8.37	2.25	0.152**	0.465***	0.470***	0.843				
5. Performance appraisal	7.75	1.82	0.186***	0.469***	0.465***	0.596***	0.789			
6. Compensation	6.65	2.45	0.141**	0.284***	0.264***	0.316***	0.337***	0.773		
7. Knowledge codification	2.82	0.68	0.128*	0.400***	0.501***	0.402***	0.432***	0.188***	0.760	
8. Knowledge personalization	2.74	0.56	0.225***	0.369***	0.456***	0.460***	0.479***	0.227***	0.603***	0.791

\*  $p < 0.1$ .

\*\*  $p < 0.05$ .

\*\*\*  $p < 0.01$ .

as López-Nicolás and Meroño-Cerdán (2011). This measure consists of six items defined on a 5-point Likert scale (see Appendix II) to identify and evaluate the approach the company takes to knowledge management. The higher the rating given by the company to each item, the more the company is involved in intensive knowledge management. Of the six items, the first three represent knowledge codification initiatives ( $\rho_c = 0.801$  and  $\text{ave} = 0.578$ ), while the remaining three are knowledge personalization practices ( $\rho_c = 0.833$  and  $\text{ave} = 0.626$ ).

#### Firm performance

Firm performance was measured using an indicator that combines global economic and financial performance of the company (Beltrán-Martín, Roca-Puig, Escrig-Tena, & Bou-Llugar, 2008; Delaney & Huselid, 1996; Sanchez-Marin, Baixauli-Soler, & Lucas-Perez, 2011). Specifically, we used an indicator that reflects the return on sales (ROS), return on assets (ROA) and return on equity (ROE) of the companies in the sample, measured as the average value for each year from 2010 to 2012, using information from the SABI database (composite reliability is  $\rho_c = 0.877$  and average variance extracted,  $\text{ave} = 0.712$ ). Using an average of 3 years' firm performance is intended to maintain the stability of the measure over time, at the same time as avoiding any distortion introduced by the delay between the implementation of a knowledge management strategy and human resource practices and firm performance (Aragón-Sánchez, Barba-Aragón, & Sanz-Valle, 2003; Sanchez-Marin and Baixauli-Soler, 2015).

#### Control variables

Two control variables were included. The first is firm size, as companies may have organizational characteristics and deploy various resources according to their size (Gilman & Raby, 2013). Firm size was measured as its total number of employees. The second is the technological intensity, since this is an indicator that reflects any differences in strategies toward knowledge and human resource practices (Lepak, Takeuchi, & Snell, 2003). Technological intensity was measured using the OECD's 2011 classification (ISIC REV 3 Technology Intensity Definition, 2011), which ranks companies on a scale with two levels of low or medium-low technological intensity, with a value of zero, or for high or medium-high technological intensity, with a value of unity.

#### Goodness of fit model: reliability and validity

For the measurement model assessment two-stage procedure recommended by Anderson and Gerbing (1988) was followed. In the first stage, we estimated the measurement model using confirmatory factor analysis (CFA) using the method of maximum likelihood, which is suitable when the normality of the data is given (Chou, Bentler, & Satorra, 1991; Fornell & Larcker, 1981; Gerbing & Anderson, 1988; West, Finch, & Curran, 1995). In this case we

have used the indices proposed by Fornell and Larcker (1981) and Bagozzi and Yi (1988, 2012) of average extracted variance (ave) and composite reliability ( $\rho_c$ ) respectively, as they provide indicators that are more accurate than other methods, and also using the chi-square statistical distribution of Satorra-Bentler (Hair, Anderson, Tatham, & Black, 2006; Satorra & Bentler, 1994; West et al., 1995).

The CFA adjustment measures were estimated using EQS V.6.3. As shown in Appendix II, the indicators are within the ranges recommended in the literature (Anderson & Gerbing, 1988; Fornell & Larcker, 1981; Hoyle & Panter, 1995; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003), so there is a good fit and the robustness of the model is assured ( $\chi^2 (224) = 288.74$  ( $p = 0.002$ ),  $\text{NFI} = 0.90$ ,  $\text{NNFI} = 0.96$ ,  $\text{CFI} = 0.97$ ,  $\text{IFI} = 0.98$ ,  $\text{RMSEA} = 0.04$ ). If we focus on the analysis of individual indicators for each item, all have significant values for their standardized coefficients ( $p < 0.05$ ), being the model suitable for measuring the specified constructs. Regarding internal consistency, all scales have an appropriate value of  $\rho_c$  greater than 0.6 (Bagozzi and Yi, 1988, 2012). With respect to convergent validity, all scales have an ave above the recommended limit of 0.5, while the discriminant validity has been confirmed by checking that the square root of ave (values on the diagonal of Table 2) is greater than the correlations between constructs (off-diagonal in Table 2) (Fornell & Larcker, 1981).

Table 3 shows the estimated second-order construct for strategic human resource practices. Construct estimators for the second order of the five first-order factors are significant, as well as indicators of overall model fit ( $\chi^2 (84) = 151.943$  ( $p = 0.000$ ),  $\text{NFI} = 0.91$ ,  $\text{NNFI} = 0.95$ ,  $\text{CFI} = 0.96$ ,  $\text{RMSEA} = 0.06$ ), as recommended in the literature (Hoyle & Panter, 1995). In addition, the model has a T ratio (ratio of the total value of  $\chi^2$  of first and second order) of 0.84, indicating that the higher order factor represents a very large proportion of the covariance between factors of the first order, implying the relationship is captured appropriately and sufficiently by the second order (Marsh & Hocevar, 1985). Table 4 shows the estimated second-order construct knowledge management. The estimates for the two prime factors are significant and the results suggest a good fit of the model specification ( $\chi^2 (6) = 13.050$  ( $p = 0.042$ ),  $\text{NFI} = 0.98$ ,  $\text{NNFI} = 0.97$ ,  $\text{CFI} = 0.98$ ,  $\text{RMSEA} = 0.08$ ), which is also confirmed by the T relationship, with a value of 0.87, indicating that the higher order factor represents a significant proportion of the covariance of the first-order factors (Marsh & Hocevar, 1985).

**Table 3**

Second order construct for strategic human resource practices.

Variables	Factor loadings	Composite reliability
Staffing	0.767	0.840
Training	0.765	
Participation	0.755	
Performance appraisal	0.811	
Compensation	0.449	

$\chi^2 (84) = 151.943$  ( $p = 0.000$ ),  $\text{NFI} = 0.91$ ,  $\text{NNFI} = 0.95$ ,  $\text{CFI} = 0.96$ ,  $\text{RMSEA} = 0.06$ .

**Table 4**  
Second order construct for knowledge management.

Variables	Factor loadings	Composite reliability
Knowledge codification	0.743	0.871
Knowledge personalization	0.999	

$\chi^2 (6) = 13.050 (p = 0.042)$ , NFI = 0.98, NNFI = 0.97, CFI = 0.98, RMSEA = 0.08.

**Results**

*Descriptive analysis and structural model*

Table 5 shows the means, standard deviations and correlations of the variables. It can be seen that there are correlations between them, although they are not very high except, as expected, the correlation between strategic human practices and knowledge management.

Table 6 and Fig. 1 show the results of structural equation modeling. In view of the results we confirm hypothesis 1 as knowledge management has a positive effect on firm performance, with a direct effect of 0.18 (Model 1). Similarly, it is found that strategic human resource practices have a positive and significant effect on firm performance, with a positive and significant direct effect of 0.31 (Model 2), confirming hypothesis 2. Also, it is confirmed that knowledge management has a positive influence on the use of strategic human resource practices, with a positive and significant direct effect of 0.78 (Model 2) and that the indirect effect of knowledge management on firm performance through strategic human resource practices is positive and significant, with a value of 0.24,

which leads us to examine the mediating effect of human resource management, as described in the mediation test set out below.

*Mediation test*

Four conditions are necessary for the existence of an effect of mediation (Baron & Kenny, 1986). First, the independent and dependent variable must be correlated: as shown in Fig. 1, the independent variable, knowledge management, and the dependent variable, firm performance, are correlated (Model 1:  $\lambda = 0.18$ ,  $p < 0.05$ ). Second, the independent variable and mediator must be correlated: the independent variable, knowledge management, and the mediator, strategic human resource practices, are correlated (Model 2:  $\lambda = 0.78$ ,  $p < 0.01$ ). Third, the mediator and the dependent variable must be correlated: the mediator, strategic human resource practices, and the dependent variable, firm performance, are correlated (Model 2:  $\lambda = 0.31$ ,  $p < 0.1$ ). Finally, the effect of the independent variable on the dependent variable should change when the mediating variable is introduced: in Model 2 it can be seen that the effect of knowledge management on firm performance changes when controlling for the strategic human resource practices, to become  $\lambda = -0.07$  ( $p > 0.1$ , not significant). Since all conditions are met, it is concluded that strategic human resource practices mediate the relationship between knowledge management and firm performance. In addition, we used the Sobel test (Baron & Kenny, 1986; Sobel, 1982) to confirm that it is complete mediation, since the test value for Sobel  $z$  is significant, and the ratio of the effect is greater than 0.8 ( $z < 1.82$ ,  $p < 0.1$ ) (Zattoni, Gnan & Huse, 2012).

**Table 5**  
Means, standard deviations, and correlations.

	Mean	S.D.	1	2	3	4
1. Firm size	4.42	0.43	1			
2. Technological intensity	0.22	-0.01	0.07	1		
3. Firm performance	2.38	7.11	0.04	0.16*	1	
4. Knowledge management	4.83	0.96	0.14**	0.07	0.20***	1
5. Strategic human resource practices	29.83	5.49	0.16**	0.14**	0.25***	0.61***

\*  $p < 0.1$ .  
\*\*  $p < 0.05$ .  
\*\*\*  $p < 0.01$ .

**Table 6**  
Direct and indirect effects in the structural model.

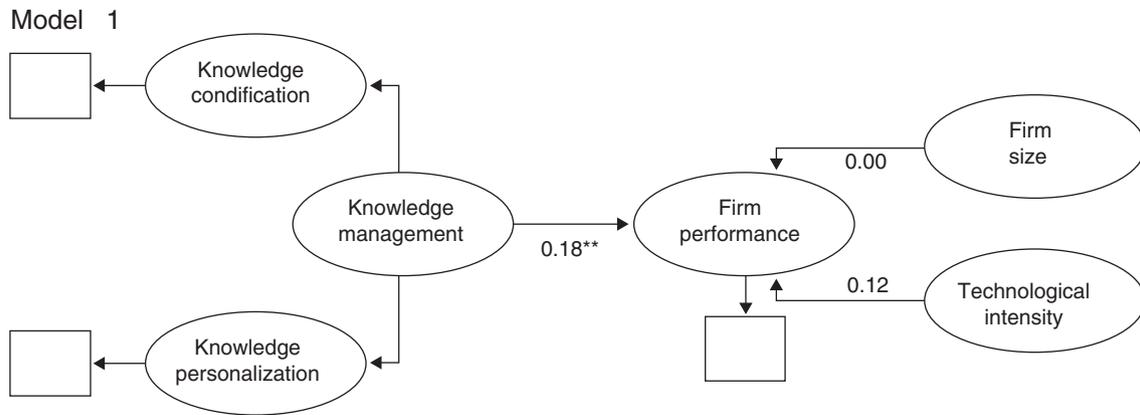
Independent variables	Dependent variables			
	Model 1		Model 2	
	Firm performance	Strategic human resource practices	Firm performance	Firm performance
	Direct effects	Direct effects	Direct effects	Indirect effects
Strategic human resource practices	-	-	0.31* (1.87)	-
Knowledge management	0.18** (2.13)	0.78*** (7.81)	-0.07 (0.41)	0.24* (1.85)
Firm size	0.00 (0.03)	-	0.01 (0.16)	-
Technological intensity	0.12 (1.41)		0.10 (1.36)	

\*  $p < 0.1$ .  
\*\*  $p < 0.05$ .  
\*\*\*  $p < 0.01$ .

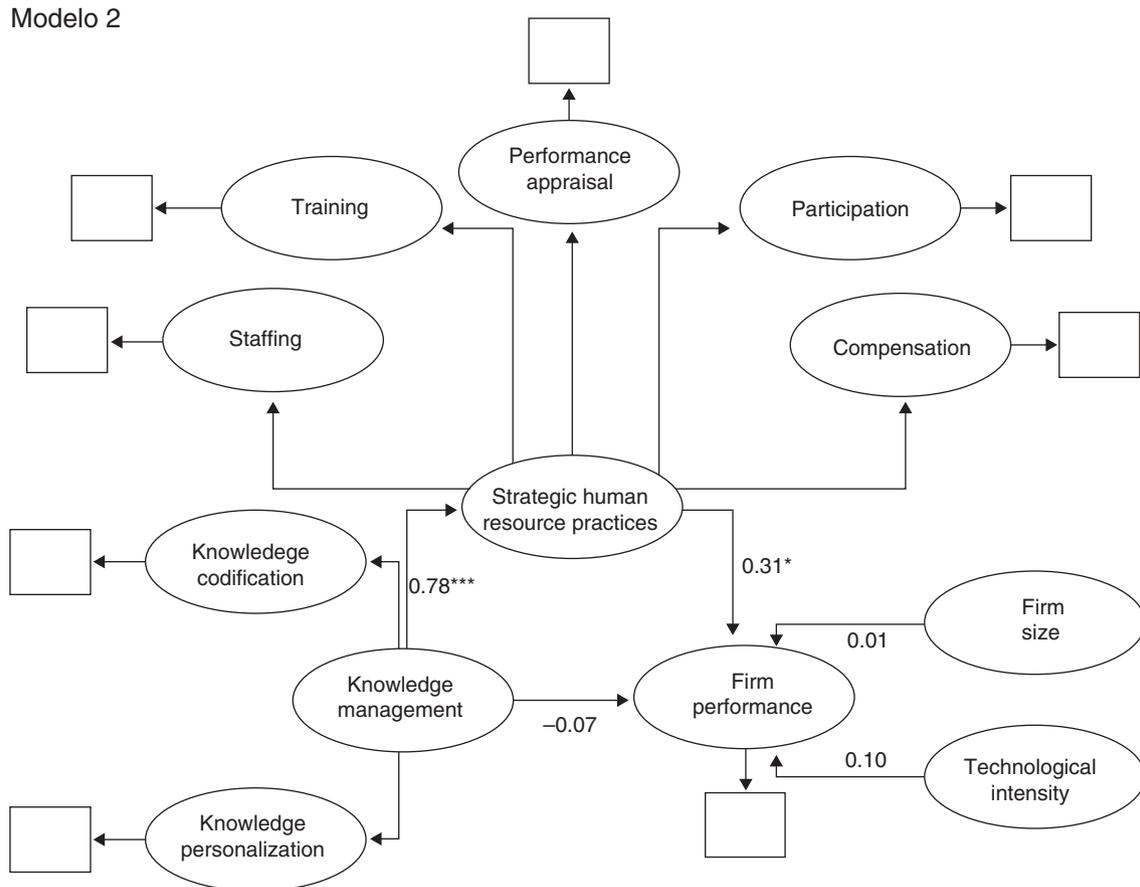
*t* values in parentheses.

Goodness of fit of model 1:  $\chi^2 (37) = 37.65$ , NFI = 0.95, NNFI = 0.99, CFI = 0.99, RMSEA = 0.02.

Goodness of fit of model 2:  $\chi^2 (283) = 381.27$ , NFI = 0.87, NNFI = 0.96, CFI = 0.96, RMSEA = 0.04.



Note:  $\chi^2$  (37) = 37.65, NFI = 0.95, NNFI = 0.99, CFI = 0.99, RMSEA = 0.02



Note:  $\chi^2$  (283) = 381.27, NFI = 0.87, NNFI = 0.96, CFI = 0.96, RMSEA = 0.04

**Fig. 1.** Relationships among knowledge codification, strategic human resource practices and firm performance.

Furthermore, the mediating effect of each of the strategic human resource practices was checked individually. This has been tested with structural models for each of the five human resource practices and the results are shown in Table 7. In terms of direct effects, knowledge management has a positive and significant effect on staffing, training, performance appraisal and participation practices which, with the exception of compensation practices, confirms the role of these practices as

disseminators of knowledge management in the organization. In terms of indirect effects, staffing and training have significant impact as mediators (total) of the relationship between knowledge management and firm performance (with coefficients of 0.49 and 0.30 respectively). In contrast, performance appraisal and participation do not exert any significance effect, despite the positive and significant influence of knowledge management on them.

**Table 7**  
Direct effects in the structural models with strategic human resource practices.

Independent variables	Dependent variables						
	Model 1	Model 2					
	Firm Performance	Staffing <sup>a</sup>	Training <sup>b</sup>	Performance appraisal <sup>c</sup>	Participation <sup>d</sup>	Compensation <sup>e</sup>	Firm performance
Knowledge management	0.18**	0.18**	0.68**	0.63***	0.57***	-0.27	n.s. <sup>f</sup>
Staffing	-	-	-	-	-	-	0.49***
Training	-	-	-	-	-	-	0.30***
Performance appraisal	-	-	-	-	-	-	0.12
Participation	-	-	-	-	-	-	0.12
Compensation	-	-	-	-	-	-	-0.15**
Firm size	0.00	0.13 <sup>†</sup>	-0.05 <sup>†</sup>	0.01	0.01	0.01	-
Technological intensity	0.12	0.09	0.12	0.08	0.08	0.10	-

<sup>\*</sup>  $p < 0.1$ .

<sup>\*\*</sup>  $p < 0.05$ .

<sup>\*\*\*</sup>  $p < 0.01$ .

Goodness of fit of model 1:  $\chi^2(37) = 37.65$ , NFI = 0.95, NNFI = 0.99, CFI = 0.99, RMSEA = 0.02.

<sup>a</sup> Fit model with staffing:  $\chi^2(58) = 58.46$ , NFI = 0.95, NNFI = 0.99, CFI = 0.99, RMSEA = 0.01.

<sup>b</sup> Fit model with training:  $\chi^2(58) = 78.44$ , NFI = 0.94, NNFI = 0.98, CFI = 0.98, RMSEA = 0.04.

<sup>c</sup> Fit model with performance appraisal:  $\chi^2(58) = 48.05$ , NFI = 0.95, NNFI = 0.99, CFI = 0.99, RMSEA = 0.01.

<sup>d</sup> Fit model with participation:  $\chi^2(58) = 70.29$ , NFI = 0.95, NNFI = 0.99, CFI = 0.99, RMSEA = 0.03.

<sup>e</sup> Fit of model with compensation:  $\chi^2(58) = 65.17$ , NFI = 0.94, NNFI = 0.99, CFI = 0.99, RMSEA = 0.03.

<sup>f</sup> In the five models with human resource practices variables as mediators, there is no significant influence of knowledge management on firm performance, with the respective following values found: 0.08, -0.03, 0.11, 0.12 and 0.13.

## Conclusions and discussion

Currently, both knowledge and human resources management have become important assets for organizations that can generate valuable and inimitable resources and capabilities for companies (Barney, 1991; Pfeffer, 1994; Wernerfelt, 1984). Several studies agree that knowledge management and human resources are closely interrelated (Afouni, 2007; Haesli & Boxall, 2005; Theriou & Chatzoglou, 2008; Wang et al., 2012), which has led to various approaches to causality between knowledge management, human resources management and firm performance (Jackson et al., 2014). This paper goes beyond the classic vision of knowledge management as a mediator of the relationship between human resource management and firm performance (Becker & Huselid, 1998; Delaney & Huselid, 1996; Delery & Shaw, 2001; Guest, 1997; Huselid, 1995) to propose an alternative model that links the role of strategic human resource practices as a catalytic mechanism that modifies the effectiveness (in terms of firm performance) of knowledge management strategies (Chuang et al., 2013; Jiang et al., 2013). Thus, it fills an important gap in this area of research, as indicated by recent reviews of literature (Jackson et al., 2014; Jiang et al., 2013) which call for studies analyzing the mediating role of human resource management in the links between knowledge management and firm performance.

Overall, this study provides empirical evidence to support the idea that a knowledge management strategy, acting as a coordinating mechanism, indicates the need for enterprise-level strategic human resource practices (Chuang et al., 2013; Liao, 2011; Wang et al., 2012), recognizing the importance of targeting these practices to create a high performance work system (Chen & Huang, 2009; Huselid, 1995). Human resource management can then play a mediating role and, therefore, determine of the effectiveness of knowledge management strategies and their contribution to the competitiveness of the company.

Specifically, our first result indicate clear support for the assumption that knowledge management has a positive impact on firm performance, consistent with most of the literature (Chen, Monahan, & Feng, 2009; Hsiao et al., 2011; Huang, 2011; López-Nicolás & Meroño-Cerdán, 2011; Palacios & Garrigós, 2006; Rašula et al., 2012). In this regard, studies point to the importance of concentrating efforts and resources on the active management of

knowledge, as this will allow companies to remain competitive and grow. Our second result evidence that the strategic human resource practices based on high performance work model (Huselid, 1995; Snell & Youndt, 1995) positively influence firm performance, which is consistent with most studies in this field (Becker & Gerhart, 1996; Chen & Huang, 2009; Collins & Clark, 2003; Delaney & Huselid, 1996; Guest, 1997; Youndt et al., 1996).

Third, and most important, our study confirmed that the strategies of knowledge management determine the strategic human resource management practices that can be used, and, in particular, guide the orientation of the management of human resources toward selective selection, intensive training, active participation and comprehensive performance appraisal. Our results support the theoretical approach of Snell and Youndt (1995), Liao (2011), Wang et al. (2012) and Chuang et al. (2013), who proposed that the knowledge management strategy indicates the company's needs in terms of human resources management. Thus companies require an appropriate mix of knowledge construction, personalization, dissemination and use of knowledge on the part of their employees, and the nature of that mix will decide which elements of a high performance work system will best align with the company's requirements, mediating then firm performance (Chuang et al., 2013; Liao, 2011).

In addition, checking the mediating effect of strategic resource management practices individually has confirmed that only staffing and training fully mediate the relationship between knowledge management and firm performance. A less prominent role can be assigned to performance appraisal and participation; although knowledge management has a significant effect on them, they cannot, alone, improve firm performance. Moreover, incentives in isolation are neither influenced by knowledge management nor do they have an effect on firm performance. This serves to highlight, as shown in the literature, that human resource practices are most effective when analyzed as systems of practices that have synergistic effects beyond the individual practices (Arthur, 1994; Chen & Huang, 2009; Delery & Doty, 1996; Huselid, 1995; MacDuffie, 1995; Youndt et al., 1996).

In this sense, we have found that there is a full mediating effect of strategic human resource practices in the relationship between knowledge management and firm performance, which corroborates the proposed model and contributes to the literature that

suggests the need for causal models where the effects of human resource management act as a mediating mechanism between knowledge management and organizational outcomes (Chuang et al., 2013; Jackson et al., 2014). In this context, our research respond to the suggestion of Jiang et al. (2013: 1469), encouraging “future researchers to explore a more complete mediation model in which HR systems can mediate the influence of organizational characteristics, including business strategy, on employee outcomes which may further lead to firm performance”. This paper, therefore, in part provides evidence in this line of research, which contributes to knowledge about the contribution of human resource systems to organizations.

Furthermore, in view of the results of this study, we can highlight several implications for business practice. On the one hand, managers should emphasize the adoption of knowledge management strategies that suit the requirements of the organization and the environment, and thus concentrate efforts and resources on the active management of such knowledge. However, there is also a need to align knowledge management with strategic human resource practices, so that they can contribute to a successful knowledge management strategy from a performance viewpoint. According to the knowledge management strategy adopted by the company, managers should select appropriate high performance work practices, focusing on construction, customization, dissemination and use of knowledge by employees. It is therefore important for companies to invest in the design and implementation of such strategic human resource practices, ranging over staffing, training, participation, evaluation and compensation.

Finally, this work is not without its limitations, which in turn provide opportunities for future research. The first limitation is linked to the restriction of the study to the context of small and medium companies, which do not usually implement the most developed business management practices, among which we can include human resource practices. It would be valuable to extend the study with larger companies, which can provide a more variable framework of human resource management. Similarly, further studies could extend the model to include other factors that may help specify the relationship between human resource management and knowledge management. For example, the inclusion of variables such as flexibility or ambidexterity of human resources could contribute to the development of the model, since it is conceivable that these factors may have moderating effects on the relationship between knowledge management and human resource practices. In much the same way it would also be desirable to test the model at different levels, analyzing the relationships from the perspective of management compared to operational considerations or taking into account the views of key employees as compared with more peripheral employees. It is also possible that the specification of the model for a specific sector could help to

deepen understanding of the mechanisms involved in determining how human resource practices contribute to the effective implementation of knowledge management strategies in the company. Nevertheless, this study is a first approach to an alternative perspective regarding the role of human resource management as a catalytic mechanism of objectives and strategies of the organization.

## Appendix I. Measurement scales

### 1. Strategic human resource practices<sup>3</sup>:

#### Staffing

STAF1. Selectivity in hiring

STAF2. Selection for expertise and skills

STAF3. Selection for future potential

#### Training

TRA1. Availability of formal training activities

TRA2. Availability of comprehensive training policies and programs

TRA3. Availability of training for new hires

#### Participation

PART1. Employees are allowed to make decisions

PART2. Employees are allowed to suggest improvements into work

PART3. Employees' voices are valued by the organization

#### Performance appraisal

APPR1. Developmental focus

APPR2. Results-based appraisal

APPR3. Behavior-based appraisal

#### Compensation

COMP1. Profit sharing

COMP2. Incentive pay

COMP3. The link between performance and reward

### 2. Knowledge codification and personalization<sup>4</sup>:

#### Knowledge codification

KC1. Knowledge (know-how, technical skill, or problem solving methods) is well codified in your company

KC2. Results of projects and meetings should be documented in your company

KC3. Knowledge is shared through codified forms like manuals or documents in your company

#### Knowledge personalization

KP1. Knowledge can be easily acquired from experts and co-workers in your company

KP2. It is easy to get face-to-face advice from experts in your company

KP3. Informal dialogs and meetings are used for knowledge sharing in your company

<sup>3</sup> Scale: 1 = minimal improvement, 5 = maximum improvement.

<sup>4</sup> Scale: 1 = minimal improvement, 5 = maximum improvement.

## Appendix II.

Confirmatory factor analysis			
Variable/items	$\lambda_{c.e}$	$\rho_c$	ave
<b>Firm performance</b>			
Return on assets (ROA)	0.984	0.879	0.712
Return on equity (ROE)	0.710		
Return on sales (ROS)	0.814		
<b>Staffing</b>			
Selectivity in hiring	0.823	0.849	0.652
Selection for expertise and skills	0.790		
Selection for future potential	0.810		
<b>Training</b>			
Availability of formal training activities	0.813	0.843	0.642
Availability of comprehensive training policies and programs	0.836		
Availability of training for new hires	0.754		
<b>Participation</b>			
Employees are allowed to make decisions	0.797	0.880	0.711
Employees are allowed to suggest improvements into work	0.843		
Employees' voices are valued by the organization	0.887		
<b>Performance appraisal</b>			
Developmental focus	0.853	0.834	0.623
Results-based appraisal	0.745		
Behavior-based appraisal	0.773		
<b>Compensation</b>			
Profit sharing	0.875	0.815	0.597
Incentive pay	0.737		
The link between performance and reward	0.694		
<b>Knowledge codification</b>			
Knowledge (know-how, technical skill, or problem solving methods) is well codified in your company	0.638	0.801	0.578
Results of projects and meetings should be documented in your company	0.731		
Knowledge is shared through codified forms like manuals or documents in your company	0.890		
<b>Knowledge personalization</b>			
Knowledge can be easily acquired from experts and co-workers in your company	0.876	0.833	0.626
It is easy to get face-to-face advice from experts in your company	0.771		
Informal dialogs and meetings are used for knowledge sharing in your company	0.718		

Goodness of fit of confirmatory factor analysis (CFA):  $\chi^2(224) = 288.74$  ( $p = 0.002$ ); NFI = 0.90; NNFI = 0.96; CFI = 0.97; IFI = 0.98; RMSEA = 0.04.

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