Building resilient clusters through HRM systems: a multiple mediator model

José Belso-Martinez
Universidad Miguel Hernandez, Elche, Spain
Daniel Palacios-Marqués
Universitat Politècnica Valencia, Valencia, Spain, and
Norat Roig-Tierno
ESIC Business and Marketing School, Valencia, Spain

Received 28 February 2017
Revised 10 June 2017
Accepted 17 July 2017

Abstract

Purpose – There is a growing research interest in the relationships between networks and the firm's assets and between networks and innovation. Studies have shown the complexity and idiosyncrasies of these relationships for firms in clusters. The way firms in clusters build certain organizational resources and capabilities, however, remains underexplored. Based on the assumption that most of these organizational assets rely on human resources, the purpose of this paper is to shed light on the mechanisms through which a set of managerial practices (the human resource management (HRM) system) enhances innovation.

Design/methodology/approach – Micro-level data were collected for 139 firms located in three Spanish industrial clusters. Next, the main constructs were developed. A multiple mediator model was then used to examine how HRM systems influence innovation through strategic vision, embeddedness in local networks, the implementation of enterprise systems, and cluster characteristics.

Findings – The effect of HRM systems on innovation performance was indirect rather than direct. All four mediating variables included in the model were found to be relevant mechanisms through which HRM systems affect innovation performance. The statistical significance of these variables, however, varied depending on the type of innovation (product, process, organizational, or marketing).

Practical implications – Greater attention should be paid to the structure and sophistication of HRM systems. Top-level managers should be aware of the linkages between HRM systems and mediators. Greater human resource orientation in strategic planning, enterprise system design, and networking practices reinforces the association between HRM systems and innovation.

Originality/value – This study advances our understanding of the mechanisms underlying the relationship between HRM systems and innovation. From an academic perspective, this study enriches the cluster literature by better integrating human resources with innovation processes. Furthermore, this study creates research opportunities by disentangling the role of different managerial practices and refining the operationalization of the mediating variables. The findings can also help managers develop human resources and innovation strategies.

Keywords Innovation, Networks, Mediation, HRM systems, Industrial clusters

Paper type Research paper

1. Introduction

Industrial clusters are hotspots for innovation (Porter, 2008; Delgado *et al.*, 2014). Firms in industrial clusters achieve better performance than they do in isolation (Baptista and Swann, 1998). Scholars generally agree that knowledge exchanges and interactive learning are the foundations of cluster innovativeness (Malmberg and Maskell, 2006; Maskell and Malmberg, 1999). The classic argument links geographic proximity to knowledge sharing – particularly complex knowledge – and innovation because this proximity enables regular personal interactions (Audretsch and Feldman, 1996). After investigating the systemic mechanisms at the firm level, economic geographers observed that the embeddedness of firms in localized networks fosters the spread of knowledge that is conducive to cluster innovativeness. Location matters, but being in the right network is probably more important than being in the right place (Giuliani and Bell, 2005).

Management Decision

0025-1747
DOI 10.1108/MD-02-2017-0175

Although interactive learning and relational capital recall the idea of automatic spillovers because knowledge is "in the air," not all firms have equal access to knowledge (Todtling *et al.*, 2013; Biggiero and Sammarra, 2010). There is increasing agreement that knowledge is exchanged selectively within a cluster's boundaries. Such heterogeneity in embeddedness combined with the firm's capacity to absorb external knowledge explains differences in innovation performance (Giuliani, 2007; Boschma and ter Wal, 2007).

The firm's absorptive capacity, also called the human capital of the firm in developmental economics, is unique to the firm and is closely linked to knowledge creation and innovation (Cohen and Levinthal, 1990; Nelson and Winter, 1982). The academic literature generally corroborates the effect of human resource management (HRM) practices on organizational learning and absorptive capacity (Lane and Lubatkin, 1998; Minbaeva *et al.*, 2003; Foss *et al.*, 2009; Murovec and Prodan, 2009; Soo *et al.*, 2017).

The traditional black box approach to studying the HRM/organizational performance dichotomy has recently elicited calls to improve our understanding of the micro-foundations of human capital-based advantages (Coff and Kryscynski, 2011) and achieve a wider consensus regarding whether and how HRM practices influence innovation (Minbaeva *et al.*, 2009). The research gap is even greater for open innovation models (Vanhaverbeke *et al.*, 2014; West *et al.*, 2014). These models prevail in contexts like industrial clusters, which represent ideal environments for the agglomeration and development of talent-related human capabilities and knowledge networks.

This study enriches the literature on HRM practices and innovation by presenting a model that combines the role of firm characteristics with external factors. The model thus aids our understanding of HRM practices as predictors of a firm's innovation. By taking insights from the literature on the microeconomics of innovation and clusters and applying these insights to the study of HRM, we advance previous research and identify several mediators that determine the strength of internal and external influences. Based on the analysis of a multiple mediation model for a sample of 139 firms from three Spanish clusters, our findings show that innovation depends not only on the richness and sophistication of the firm's HRM practices, but also on strategic vision, enterprise systems, local networks, and cluster characteristics, all of which simultaneously mediate the relationship.

The paper is organized as follows. Section 2 provides an overview of the theory and presents the hypotheses designed to disentangle the effects of different mediators on innovation performance. Section 3 describes the data, methods, and variables used in the econometric model. Section 4 presents the empirical findings of the multiple mediation analysis. Section 5 discusses the main conclusions and implications.

2. Literature and hypotheses

2.1 HRM practices and clusters

Clusters are geographic concentrations of interconnected companies and institutions operating in the same industry (Porter, 1998). These systemic structures are built on a specialized infrastructure that is generated by inter-firm coopetition and a shared talent pool of specialized skilled labor (Toulemonde, 2006). In these industrial systems, spatial proximity enables meaningful interactions, producing the knowledge spillovers that are crucial for innovation (Bathelt, 2008; Mesquita, 2007; Presutti *et al.*, 2017).

Like all firms, however, firms in clusters do not automatically benefit from being exposed to local knowledge. As highlighted in the innovation literature, the positive impact of external knowledge is subject to the combination, transformation, and integration of this knowledge with internal knowledge. To ensure external knowledge has a positive effect, firms need R&D activities that are not only robust but also decoupled from other organizational spheres (Nonaka and Von Krogh, 2009). For instance, employee mobility

is necessary to build operative connections within and beyond the firm's boundaries (Knoben and Oerlemans, 2012).

A certain level of organizational absorptive capacity that requires highly skilled human resources is necessary to turn external knowledge into innovation (Ponds *et al.*, 2010; De Noni *et al.*, 2017). Scholars have acknowledged the importance of HR and HRM practices in contributing to the firm's absorptive capacity to innovate (Vinding, 2006; Minbaeva *et al.*, 2003). Therefore, ideas are generated at a greater rate in clusters, endorsing the territorial dimension of knowledge diffusion through human capital (Roper *et al.*, 2017) and demonstrating the relevance of human resources for creating advantages from clustering (Lee *et al.*, 2010; Clarkson *et al.*, 2007).

Under the HR approach, scholars argue that a firm's individual members (Felin and Hesterly, 2007) and the capabilities resulting from interactions within that firm's human capital pool (Lepak and Snell, 2002) lead to above-average innovation performance. Accordingly, management practices providing skills and motivation reinforce the role of employees as sources of innovativeness and competitiveness (Teece, 2007; Colombo and Delmastro, 2008). Laursen and Foss (2003) differentiated between traditional HRM practices – including employee training and recruitment-retention policies – and modern HRM practices – comprising delegation of responsibility, knowledge-related incentives, and encouragement of internal communication. Over the last decade, research into how modern or traditional practices individually affect performance has given way to approaches with a broader scope based on the complementarities literature (Ennen and Richter, 2010). Such approaches consider the relative impact of an entire system of distinct yet interrelated and mutually reinforcing HRM policies and practices, rather than isolated individual HRM practices (Saridakis *et al.*, 2016).

2.2 Direct effects of HRM systems

2.2.1 HRM systems and innovation. The resource-based view highlights the impact of HRM practices on firm performance (Huselid *et al.*, 1997), particularly in terms of innovation (Almeida and Kogut, 1999; Chen and Huang, 2009; Vinding, 2004; Cabello Medina *et al.*, 2011; Cooke and Saini, 2010). Laursen and Foss (2003) found that HRM practices foster organizational learning and consequently enhance innovation. The use of incentives, teamwork, participatory programs, delegation, and decentralization help the acquisition, diffusion, and exploitation of complex knowledge, which is central to generating new ideas (Alegre and Chiva, 2008).

In clusters, spatial proximity incentivizes knowledge spillovers and knowledge sharing (Iammarino and McCann, 2006). The effectiveness of this knowledge atmosphere at boosting innovation largely depends on the firm's ability to acquire and manage existing and new knowledge (Cohen and Levinthal, 1990). Intra-firm innovation efforts such as R&D enable the exploitation of locally generated knowledge. The firm's employees house this internal knowledge (Grant, 1996), while the human capital of the firm's owners and managers contributes to coordinating and exploiting such knowledge (Colombo and Grilli, 2005). Consequently, mutual learning between the organization and its members occurs (March, 1991). The literature provides empirical evidence of the positive effect of human resources on innovation (Østergaard *et al.*, 2011; Forsman, 2011; Muscio, 2007):

H1. HRM practices foster the firm's innovation performance.

2.2.2 HRM systems, strategic vision, and innovation. The emphasis on people as strategically important elements behind a firm's success has led to an overlap between strategic and human resource issues. Each business strategy requires a specific set of behaviors and attitudes from employees. The firm's strategic vision reflects top managers'

aspirations for organizations and represents the strategy pursued by the firm (Nonaka and Takeuchi, 1995). Davenport (1999) linked the strategic vision of the organization to HRM through knowledge management. HRM is conducive to a culture of knowledge creation and diffusion, thereby improving organizational performance (Vidal-Salazar *et al.*, 2012). Accordingly, strategic vision should be combined with HRM practices to guide employees toward organizational goals (Collins and Clark, 2003) and enhance innovation (Camelo-Ordaz *et al.*, 2008). There is empirical evidence that firms with greater strategic orientation in HRM perform significantly better (Camelo-Ordaz *et al.*, 2008; Cooke and Saini, 2010; Lengnick-Hall *et al.*, 2009; Kraus *et al.*, 2007).

The firm's strategic orientation enhances the effectiveness of HRM practices at achieving superior performance as human resources become more efficient at capturing and leveraging the firm's strategic advantages (Lepak *et al.*, 2006). Therefore, strategic orientation helps translate HRM practices into performance. Relatively few studies have examined how strategic orientation mediates the HRM-performance relationship. Edelman *et al.* (2005) tested the mediating role of business strategies in the relationship between human resources and firm performance. Their study confirmed that HR together with strategy enhances firm performance. These findings thus highlight the need to implement simultaneously a particular strategic orientation and a suitable combination of skills, knowledge, and abilities. Chow *et al.* (2013) corroborated the relationships among HRM systems, strategic orientation, and performance in a cross-section of 190 firms in Singapore. Finally, Choi and Yoon (2015) used moderated mediation analysis to show how highly strategically oriented human resources reinforce the effects of HRM practices on performance:

H2. Strategic vision mediates the relationship between the firm's HRM practices and innovation performance.

2.2.3 HRM systems, networks, and innovation. Within industrial clusters, different networks coexist (Giuliani, 2007; Balland *et al.*, 2016; Sammarra and Biggiero, 2008) and interweave (Belso-Martínez *et al.*, 2017). Market-based and social relationships are conduits through which knowledge is accessed and shared. The most common sources of knowledge are links with customers, suppliers, consultants, competitors, universities, and research centers (Roper *et al.*, 2008). Moreover, local interactions and the mobility of skilled workers also represent alternative vehicles for local knowledge transfer (Capello and Faggian, 2005).

Intra-cluster networks are usually dense, a characteristic that fosters trustworthiness and complex knowledge sharing (Granovetter, 2005). Through these networks, skillful informants may furnish firms and managers with valuable information regarding suitable HRM practices and how to implement them (Rodan and Galunic, 2004). Network effects have been identified as possible mediators of the relationship between HRM practices and innovation (Laursen and Foss, 2014; Eggers *et al.*, 2014). For instance, network competence that is derived from certain HRM practices such as intra-firm communication positively affects a firm's innovation (Ritter and Gemünden, 2003; Roessl *et al.*, 2010). Arguably, therefore, HRM practices foster networking and the accumulation of network-related capabilities, which in turn enhance innovation:

H3. Local networking mediates the relationship between the firm's HRM practices and innovation performance.

2.2.4 HRM systems, enterprise systems, and innovation. The literature is inconclusive regarding the effects of information and communication technologies (ICTs) on innovation (Zand, 2010). On the one hand, ICTs may hamper innovation if they constrain innovative thinking through rigidity, inertia, and resistance to change. On the other hand, ICTs may be

essential to the innovation process if they enable timely access to accurate information, accelerating capacity building through absorptive capacity and innovation-related processes.

The few studies that link HRM practices to innovation generally coincide in highlighting the relevance of HRM practices and ICTs that are focused on leveraging employees' capabilities and performance to reinforce innovation (Laursen, 2002; Laursen and Foss, 2003; Arvanitis, 2005; Bourke and Crowley, 2015). Essentially, therefore, the gains from adopting HRM practices are greater if these practices are supported by investment in suitable ICTs (Hollenstein, 2004), while ICT adoption is subject to necessary adjustments at the employee and organizational levels (Arvanitis, 2005).

According to Gertler (2003) and Hsu *et al.* (2014), customer relationship management (CRM) and enterprise resource planning (ERP) are ICTs that provide the impetus to develop capabilities to outperform competitors[1]. Studies have shown how the involvement of human resources throughout the organization (Finnegan and Currie, 2010) and the workforce's skill structure (Hidalgo Pérez *et al.*, 2016; Falk and Biagi, 2016) shape the adoption and subsequent success of these ICTs. These arguments apply especially to industrial clusters because the positive effects of human capital explain the spatial concentration of firms (Toulemonde, 2006):

H4. The use of enterprise systems mediates the relationship between the firm's HRM practices and innovation performance.

2.2.5 HRM systems, clusters characteristics, and innovation. The agglomeration of professional talent is commonly recognized as a crucial element of regional capital that explains the existence and competitiveness of industrial systems (Leonard and Swap, 2000; Baptista and Swann, 1998). By belonging to an industrial cluster, firms can access this pool of skilled labor and thus improve performance (Gertler, 2003). In addition, individual skills improve faster if the worker interacts more often with other highly skilled workers.

A cluster's ability to attract and retain good workers is shaped by the cluster's human resource environment, which in turn depends on the local socioeconomic environment and human resource policies (Weng and McElroy, 2010). At the firm level, the relative attractiveness of the cluster's human resource environment may affect HRM practices. For instance, talented individuals prefer clusters with diversity and amenities, and human resource policies may determine the degree to which individual firms compete for skillful resources. These preferences place demands on organizations to develop suitable managerial practices.

From another perspective, although HRM practices are likely to enhance innovative activity, such practices are unlikely to be equally effective across different sectors. Drawing on arguments from the organizational literature, Laursen (2002) suggests that organic structures (flexible, decentralized, informal, team based, and highly integrated) suit knowledge-intensive industries because such structures deal better with uncertainty and the exploitation of local knowledge. Laursen (2002) reports empirical evidence of a greater innovation output for moderately and highly knowledge-intensive industries because of HRM practices:

H5. The type of cluster mediates the relationship between the firm's HRM practices and innovation performance.

3. Method

3.1 Motivations for the choice of region and clusters

The empirical study examined three clusters, each belonging to a different industry. These clusters were chosen for three reasons. First, the availability of network data was good.

Within the Region of Valencia, it was feasible to identify industries and clusters populated by a workable number of firms. The Region of Valencia also offered a favorable environment for the long interviews necessary to address relational questions. By focusing on this region, we developed a homogeneous data set that allowed us to study network structures and their effects from a rich, multi-cluster perspective.

Second, the three industries that were selected (toys, foodstuff, and biotech) have diverse innovation paradigms and HRM-related practices. These industries have evolved differently over the last decade. While the biotech cluster is in its early stages of development, the foodstuff cluster has long been a mature, profitable industry based on a unique product. The toy cluster has undergone massive transformations over the last decade. The strength of a specialized supply industry has allowed firms in the toy sector to diversify activities and move into other sectors thanks to novel applications of accumulated knowledge and technological capabilities.

Third, although most firms in these sectors are SMEs, all three industries contain several large firms and even some multinational corporations. Contrary to previous research (Giuliani, 2007, 2013), therefore, cluster firms cannot always be conceived as simple economic agents with limited organizational forms. The coexistence of both simple and complex organizational structures was highly relevant in this research because the study explored not only inter-firm relations, but also intra-organizational functioning.

In sum, these three industrial clusters were selected because of marked differences that allowed us to make valuable meso-level comparisons, their idiosyncratic nature and territorial embeddedness, their contribution to regional economic growth, and low research costs.

3.2 Data collection

To meet our objectives, we conducted cross-case analysis in three industrial clusters using a mixture of qualitative and quantitative methods. First, the background and status of the three clusters were explored using all available documents and materials as well as several qualitative interviews with academic experts, practitioners, and policymakers. Based on these insights and a comprehensive literature review, a questionnaire was designed to collect general data on the firms' networking, innovation, and HRM practices. A draft version of the questionnaire was pre-tested with five firms per cluster. Certain aspects were modified according to respondents' feedback. Following these changes, the questionnaire was ready for submission.

In total, 147 firms in the toy, foodstuff, and biotech clusters were identified from business associations' records. Following the key informant method, a single respondent from each organization was used. Because of the complex nature of the phenomena under study, top managers or business owners were expected to be the only organizational members with sufficient knowledge to answer the questionnaire. Once the firms had been contacted and the project had been explained, top managers or business owners from 139 firms completed our face-to-face questionnaire between mid-September 2012 and early November 2013.

To avoid bias, the same experienced interviewer performed all interviews. Following Podsakoff *et al.* (2003), we used Harman's single factor test to discard the possibility of spurious variance attributable to the measurement method. Furthermore, data were collected sequentially (i.e. one cluster after the other) to prevent early and late response bias. Despite the high response rate, we checked for non-response bias by comparing the key characteristics of respondents with those of non-respondents. No significant differences were found.

The insights that we obtained allowed us to design the structured questionnaire and enriched the discussion of our results. Following pre-testing, the structured questionnaire

was administered by a skillful technician to business owners and top managers. Each interview lasted around 45 minutes and gathered data on the firm's characteristics, innovation practices, inter-organizational relationships, and performance.

4. Empirical results

4.1 Measures and constructs

Constructs of interest in this study were evaluated by adapting established measures to our research context. Product innovation was operationalized using four binary items that evaluated whether a firm introduced a new product or service to the firm or the market in the last three years. Process innovation was measured using three items evaluating whether a firm introduced new operational practices in manufacturing, logistics, or support activities. Organizational innovation was operationalized using three questions assessing the adoption of advances in terms of organizational procedures, structure, and knowledge sharing. Marketing innovation was operationalized using four items that indicated whether the firm made changes in areas such as packaging, promotion, and positioning. Finally, overall innovation combined information from all previously mentioned items. Table I details the items (construct measurement) that were analyzed using factor analysis to form a unique innovation-related factor (construct) with an eigenvalue greater than 1.

The "HRM systems" variable reflected the number of HRM practices used by the firm. Each interviewee was specifically asked whether the firm implemented different modern and traditional HRM practices (rotations, teams, training, incentives, etc.). Next, answers regarding all practices were merged to create a unique count variable ranging from 0 to 7. The rationale underlying this variable was that more HRM practices implied that the HRM systems would be more sophisticated.

Construct name	Construct measurement	Mean (SD)	α
Product innovation	New or significantly improved products (dummy 0/1)	0.803 (0.399)	0.71
	New or significantly improved services (dummy 0/1)	0.504 (0.502)	
	New or significantly improved products or services already available in the market (dummy 0/1)	0.715 (0.453)	
	New or significantly improved products or services unavailable in the market (dummy 0/1)	0.672 (471)	
Process innovation	New or significantly improved manufacturing methods (dummy 0/1)	0.511 (0.502)	0.74
	New or significantly improved logistic systems or delivery methods for inputs, product, or services (dummy 0/1)	0.518 (0.501)	
	New or significantly improved support activities such as purchasing and IT (dummy 0/1)	0.890 (0.313)	
Organizational innovation	New practices in work organization or organizational procedures (dummy 0/1)	0.598 (.492)	0.70
	New methods of organizing workplaces for better responsibility sharing and decision making (dummy 0/1)	0.638 (0.498)	
	New knowledge management systems to improve the use and exchange of knowledge within the company or to gather external information (dummy 0/1)	0.591 (0.493)	
Marketing innovation	Significant changes in product design and/or packaging (dummy 0/1)	0.625 (0.486)	0.70
	New techniques or channels for product promotion (dummy 0/1)	0.460 (0.500)	
	New methods for positioning the product in the market (dummy 0/1)	0.453 (0.499)	
	New methods for establishing the prices of goods or services (dummy 0/1)	0.263 (0.442)	
Overall innovation	All items included in product innovation, process innovation, organizational innovation, and marketing innovation		0.84

Table I. Innovation constructs, measures, and descriptive statistics

The variable "strategic vision" was a count of questionnaire answers regarding a firm's implementation (or lack thereof) of three strategic planning tools: technological vigilance systems, innovation plans, and strategic plans. The variable ranged from 0 to 3 depending on the number of tools used. Similarly, "local networks" was a count of questionnaire answers regarding the existence (or absence) of relationships with suppliers, customers, competitors, technology centers, and universities located within the cluster's boundaries. The variable ranged from 0 (no linkages) to 5 (relationships with all groups).

Interviewees were also asked if the firm had a CRM system and/or an ERP system. Answers were used to build the variable "enterprise systems," which ranged from 0 to 2, with 2 indicating coexistence of the two systems within the firm. The variable "cluster" identifies the industry of each cluster (1 = foodstuff; 2 = toy; 3 = biotechnology). Finally, the variable "R&D effort" was operationalized as the average R&D expenditure divided by total sales over the last three years. "Size" was operationalized as the average number of employees over the last three years. Tables II and III provide detailed information on the explanatory variables.

Table II.
Explanatory variables, measures, and descriptive statistics

Variable name	Measurement	Mean (SD)/%
HRM system	*Questionnaire answers*	
	Employees influence the design of the organization's policies and work (dummy 0/1)	0.892 (0.311)
	Teams have the autonomy to make their own decisions (dummy 0/1)	0.892 (0.311)
	Inter-departmental teams are created frequently (dummy 0/1)	0.446 (0.499)
	Employees are rotated across different functional areas or departments (dummy 0/1)	0.446 (0.499)
	There are training programs (dummy 0/1)	0.241 (0.429)
	There are incentives for employees to update or improve knowledge and/or skills (dummy 0/1)	
	There are incentives associated with the input of new ideas by employees (dummy 0/1)	0.288 (0.454)
	Count variable recording the number of practices implemented by the firm (0-7)	0.345 (0.477)
Strategic vision	*Questionnaire answers regarding the implementation of*	
	Technological vigilance systems (dummy 0/1)	0.338 (0.475)
	Innovation plans (dummy 0/1)	0.122 (0.329)
	Strategic plans (dummy 0/1)	0.252 (0.436)
	Count variable recording the number of tools used by the firm (0-3)	
Local networks	*Answers to questions about the existence of intra-cluster linkages with*	
	Suppliers (dummy 0/1)	0.906 (0.292)
	Customers (dummy 0/1)	0.928 (0.259)
	Competitors (dummy 0/1)	0.403 (0.492)
	Technology centers (dummy 0/1)	0.611 (0.489)
	Universities (dummy 0/1)	0.352 (0.479)
	Count variable recording the number of intra-cluster linkages confirmed by the firm (0-5)	
Enterprise system	*Questionnaire answers regarding the implementation of*	
	ERP (dummy 0/1)	0.273 (0.447)
	CRM (dummy 0/1)	0.281 (0.451)
	Count variable recording the number of tools implemented by the firm (0-2)	
Cluster	Took the value 1 if the firm was located in the foodstuff cluster	25.9%
	Took the value 2 if the firm was located in the toy valley cluster	54.0%
	Took the value 3 if the firm was located in the biotech cluster	20.1%
Innovation effort	Average R&D expenditure on total sales over the last three years	16.338 (22.543)
Size	Average number of employees over the last three years	30.387 (54.006)

4.2 Econometric analysis

Mediation effects were tested using bootstrapping, a non-parametric procedure that does not require the assumption of normality of sampling distributions (Preacher and Hayes, 2008). We followed Preacher and Hayes' (2008) recommendations and tested a multiple mediation model without excluding any variables. The results thus represent mediation effects conditional on the presence of all other mediators. The results should, therefore, suffer less from omitted variable bias. To avoid making distributional assumptions, we used 95 and 99 percentile bootstrap CIs to estimate the significance of the mediation effects.

Calculation of the mediation effects followed four steps (Preacher and Hayes, 2008). First, from the data set of 139 firms, 5,000 bootstrap samples were randomly generated using random sampling with replacement. Second, regression coefficients accounting for the effect of the independent variable on the mediator (path a), the effect of the mediator on the dependent variable (path b), and the mediation effect estimates ($a \times b$) were calculated based on this bootstrap sample. Third, this process was repeated 5,000 times, yielding 5,000 estimates of the mediation effect of interest. Fourth, the mean of the 5,000 indirect effect estimates was calculated. If 0 was outside the 95% confidence interval of the estimate, the indirect effect was statistically significant.

Figure 1 presents a diagram of the multiple mediation model. Testing was performed using Preacher and Hayes' (2008) macro. The total effect model (c) showed the total effect of "HRM systems" on different types of innovation. The model with multiple mediation design showed the effect of "HRM systems" on innovation as the sum of the direct effect (c') and indirect effects ($a_1b_1 + a_2b_2 + a_3b_3 + a_4b_4$). The estimation of the indirect effects used the product of path coefficients for each path in the mediation chain.

As Table IV illustrates, "HRM systems" had a significant total effect on different types of innovation: overall innovation ($c = 0.0150$; $p < 0.01$), product innovation ($c = 0.125$; $p < 0.01$), process innovation ($c = 0.111$; $p < 0.01$), organizational innovation ($c = 0.112$; $p < 0.01$), and marketing innovation ($c = 0.100$; $p < 0.05$). This effect varied by up to 25 percent depending on the type of innovation.

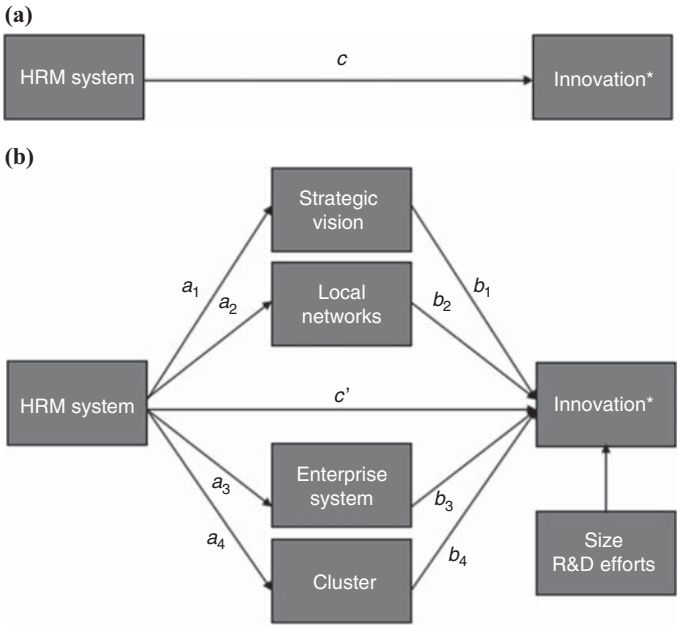
In this second procedure, we compared the direct effect (c') with the total effect (c). After controlling for the four proposed mediators (see the corresponding model in Figure 1), the effect of "HRM systems" was non-significant on the dependent variables. Only organizational innovation was significant ($c' = 0.095$; $p < 0.1$). The total variance accounted for by the overall model – comprising "HRM systems," the four mediators, and the controls – ranged from 21.1 percent in the product innovation model to 49.7 percent in the overall innovation model.

Our final procedure carefully examined the multiple mediation effects. Significance of the mediators was determined when 0 was outside the 95 percent confidence interval (Table V). Depending on the type of innovation, there were differences in the way the four proposed mediators mediated the relationship between "HRM systems" and the five

HRM systems	1						
Strategic vision	0.409***	1					
Local networks	0.475***	0.511***	1				
Enterprise systems	0.290***	0.365***	0.227***				
Cluster	0.608***	0.299***	0.550***	0.245***	1		
R&D	0.318***	0.360***	0.324***	0.088	0.360***	1	
Size	−0.085	0.232***	0.042	0.419***	−0.246***	−00.12	1
Mean	3.598	0.712	2.885	0.554	1.956	16.338	30.387
SD	2.049	0.979	1.222	0.800	0.674	22.543	54.006

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

Table III.
Correlation and descriptive statistics



Notes: (a) Model with total effect; (b) model with multiple mediator design. HRM systems → Innovation* = c'; HRM systems → Strategic vision → Innovation* = a_1b_1; HRM systems → Local networks → Innovation* = a_2b_2; HRM systems → Enterprise systems → Innovation* = a_3b_3; HRM systems → Cluster → Innovation* = a_4b_4. Depending on the model, innovation refers to overall innovation, product innovation, process innovation, organizational innovation, or marketing innovation

Figure 1.
Diagram of the multiple mediation models

	Overall innovation		Product innovation		Process innovation		Organizational innovation		Marketing innovation	
	Model 1 (*a* path)	Model 2 (*b* path)	Model 1 (*a* path)	Model 2 (*b* path)	Model 1 (*a* path)	Model 2 (*b* path)	Model 1 (*a* path)	Model 2 (*b* path)	Model 1 (*a* path)	Model 2 (*b* path)
Strategic vision	0.128***	0.368***	0.128***	0.012	0.128***	0.332***	0.128***	0.226**	0.128***	0.330***
Local networks	0.257***	0.222***	0.260***	0.264***	0.256***	0.197**	0.256***	0.201	0.257***	0.129
Enterprise systems	0.137***	0.271***	0.137***	0.138	0.137***	0.342***	0.137***	0.318***	0.137***	0.266**
Cluster	0.170***	−0.113	0.169***	0.063	0.169***	−0.356***	0.169***	−0.633***	0.171***	0.164
	Total effect (*c* path)		Total effect (*c* path)		Total effect (*c* path)		Total effect (*c* path)		Total effect (*c* path)	
HRM systems	0.150***		0.125***		0.111***		0.112***		0.100**	
	Direct effect (*c*′ path)		Direct effect (*c*′ path)		Direct effect (*c*′ path)		Direct effect (*c*′ path)		Direct effect (*c*′ path)	
HRM systems	0.028		0.026		0.031		0.095*		−0.040	
	Partial effect control		Partial effect control		Partial effect control		Partial effect control		Partial effect control	
R&D	0.005		0.000		0.005		0.008**		0.002	
Size	0.001		0.003		0.002		0.001		0.001	
	Explained variance 49.7%		Explained variance 21.1%		Explained variance 44.1%		Explained variance 34.3%		Explained variance 32.7%	

Notes: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$ (based on 5,000 bootstrap resamples)

Table IV.
Effects on endogenous variables

Table V.
Summary of mediating effects

	Overall innovation			Product innovation			Process innovation			Organizational innovation			Marketing innovation		
		LCI	UCI		LCI	UCI		LCI	UCI		LCI	UCI		LCI	UCI
Strategic vision	0.047	0.017	0.096	0.002	−0.023	0.037	0.043	0.0165	0.092	0.029	0.005	0.073	0.042	0.011	0.098
Local networks	0.057	0.020	0.111	0.068	0.024	0.127	0.050	0.0104	0.108	0.051	0.006	0.113	0.033	−0.015	0.082
Enterprise systems	0.037	0.013	0.081	0.019	−0.012	0.070	0.046	0.0191	0.095	0.043	0.015	0.093	0.037	0.007	0.086
Cluster	−0.019	−0.074	0.027	0.011	−0.063	0.084	−0.060	−0.133	−0.007	−0.107	−0.180	−0.053	0.028	−0.031	0.108
Total (ab path)	0.122	0.059	0.199	0.099	0.035	0.176	0.080	0.010	0.159	0.017	−0.051	0.103	0.140	0.072	0.231

Notes: Results based on 5,000 bootstrap resamples and 95 percent level of confidence for confidence intervals

operationalizations of innovation. The statistical significance of the mediators varied across the five models, reflecting the complexity of the relationship between HRM practices and innovation.

In the overall innovation model, the mediated effect of "HRM systems" through "strategic vision" was significant ($ab = 0.047$; LCI = 0.017, UCI = 0.096). The mediated effect of "HRM systems" through "local networks" was also significant ($ab = 0.057$; LCI = 0.020, UCI = 0.111). Enterprise systems also mediated significantly ($ab = 0.037$; LCI = 0.013; UCI = 0.081). The mediated effect of "HRM systems" through "cluster" was non-significant ($ab = -0.019$; LCI = −0.074; UCI = 0.027).

The only significant mediator of the effect of "HRM systems" on "product innovation" was "local networks" ($ab = 0.037$; LCI = 0.013; UCI = 0.081). The other three potential mediators were non-significant. Neither "strategic vision" ($ab = 0.002$; LCI = −0.023; UCI = 0.037), "enterprise systems" ($ab = 0.019$; LCI = −0.012; UCI = 0.070), nor "cluster" ($ab = 0.011$; LCI = −0.063; UCI = 0.084) was significant.

Regarding "process innovation", the paths via "strategic vision" ($ab = 0.043$; LCI = −0.016; UCI = 0.092), "local networks" ($ab = 0.050$; LCI = −0.010; UCI = 0.011), "enterprise systems" ($ab = 0.046$; LCI = −0.019; UCI = 0.095), and "cluster" ($ab = -0.060$; LCI = −0.133; UCI = −0.007) were all statistically significant. Similarly, the paths to "organizational innovation" through "strategic vision" ($ab = 0.029$; LCI = −0.005; UCI = 0.073), "local networks" ($ab = 0.051$; LCI = −0.006; UCI = 0.113), "enterprise systems" ($ab = 0.043$; LCI = −0.015; UCI = 0.093), and "cluster" ($ab = -0.107$; LCI = −0.180; UCI = −0.053) were significant.

Two mediated effects on marketing innovation were significant. Both "strategic vision" ($ab = 0.042$; LCI = −0.011; UCI = 0.098) and "enterprise systems" ($ab = 0.037$; LCI = 0.007; UCI = 0.086) were significant. Neither "local networks" ($ab = 0.033$; LCI = −0.015; UCI = 0.082) nor "cluster" ($ab = 0.028$; LCI = −0.031; UCI = 0.108) significantly improved marketing innovation.

5. Discussion and conclusions

Intense competition in global markets encourages firms and territories to create value through innovation. The creation of new products and solutions, however, relies not only on organizational capabilities, but also on skilled, creative human resources. Accordingly, HRM practices adopted by firms have traditionally been linked to innovation both directly and indirectly. This study fills a major research gap by answering recent calls for nuanced studies that examine the mechanisms through which HRM systems foster innovation. We contribute to opening this black box by simultaneously analyzing the mediating effects of firm- and context-related factors using five separate operationalizations of innovation. Based on analysis of a sample of 139 firms across three industrial clusters, our results show the positive relationship between the adoption of HRM practices and a firm's innovation performance. As expected, however, the effect is essentially a mediated effect.

We placed HRM systems at the beginning of the process, considering HRM to be a main antecedent of innovation. Strategic vision, local networks, enterprise systems, and type of cluster mediated the relationship between HRM systems and innovation. The results confirm that all four variables mediate the effect of HRM systems on innovation. The relevance of the indirect effect, however, was observed to be contingent on the type of innovation. This finding highlights the complexity of the effect of HRM practices on innovation and the need for a refined approach when designing either firm-level strategies or innovation policies. The following paragraphs highlight our key findings and their implications.

First, firms traditionally strive to improve their HRM so that they can innovate. The results of the total effect model indicate that more sophisticated HRM systems are

associated with better innovation performance. When mediators were considered, however, this direct effect vanished. Although this finding confirms the relevance of a firm's HRM system, the vital role of such systems decreases as a function of the mediator and type of innovation. Specifically, we found that HRM systems affect firm innovation performance indirectly through strategic vision. Accordingly, top managers and business owners should consider this indirect effect when implementing strategic HRM practices and should adopt a strategic orientation to enhance the contribution of HRM systems to organizational performance. Thus, human resource managers should increase their involvement in strategy design and decision processes to ensure a better fit between the HRM system's structure and the firm's specific long-term innovation goals.

Second, the firm's relations in local networks mediate the relationship between HRM and innovation. This finding is consistent with the literature, which highlights the indirect effect of firm-level networking capabilities, defined as the ability to handle and apply inter-organizational knowledge. Local networking activities are fostered through inputs from various organizational perspectives, particularly human resources, if they are properly oriented toward networking. Through successful relational activities, firms accrue external knowledge, which is crucial for sustaining innovation activities. Consequently, our findings imply that a networking culture should be instilled throughout the whole organization. Human resource managers should adopt a particularly strong networking culture to promote a more open and interactive philosophy.

Third, we hypothesized that ICT payoffs rely on complementary organizational structures and HRM. Enterprise systems are common among organizations with well-established routines and well-developed technological capabilities. Due to its rigidity and resistance to change, however, this particular profile sometimes slows the extraction of the knowledge advantages that can be derived from enterprise systems. Our analysis confirms the mediating role of enterprise systems in the relationship between HRM systems and innovation. This finding supports the theory that HRM systems foster innovation by alleviating problems and capitalizing on knowledge opportunities that are created by enterprise systems. Organizations that intend to use enterprise systems as a basis for innovation practices need to reorient their HRM systems so that human resources play a crucial role. Suitable HRM systems may convert human resources into the engine that transforms the enterprise system into a real knowledge contributor capable of generating actionable improvements in innovation performance. A traditional approach to managing people may not represent the most suitable strategy. Recasting HRM systems to emphasize knowledge management offers an appropriate path for rethinking human resource managers' responsibility and enhancing these managers' contributions to enterprise innovation success.

Fourth, the mediating effect of the "cluster" variable highlights the intimate relationship between cluster innovativeness and human resource practices. Sophisticated HRM systems enrich human resources, leading to better performance at both micro and cluster levels. Policy programs should promote HRM practices such as internal mobility and teamwork, which may result in greater creativity and complex knowledge transfers. Furthermore, specific cluster characteristics shape the way human resources and related practices indirectly contribute to innovation. Thus, HRM systems seem to be more relevant during the early stages of the life cycle in knowledge-intensive industrial sectors.

Finally, this research has some limitations, which provide opportunities for future research. A first limitation relates to the way we addressed HRM systems. We treated HRM systems as collections of different managerial practices and ignored aspects such as the coordination of these practices and their profile (i.e. modern vs traditional). Future studies should consider the effect of different HR-related managerial practices on innovation through the proposed mediators. A second limitation relates to the prevalence of SMEs in the sample. Such firms rarely employ sophisticated strategic and HRM practices.

We also analyzed three industrial clusters with different characteristics. Future studies could extend our focus by including a significant number of large firms or other industrial systems or by comparing differences between firms in clusters and firms not in clusters. Future studies could also consider alternative approaches in the operationalization of innovation (e.g. radical vs incremental) and alternative variables with indirect effects (e.g. flexibility and the HR environment). Likewise, it would be of interest to test our model dynamically or at a higher level by analyzing the relationships at the meso level rather than the micro level. Finally, a systematic sector approach might help identify differences in the way HRM systems contribute to innovation. Despite these limitations, this research is a first step to improving our understanding of the role of HRM systems in organizational innovation capability and performance.

Note

1. The CRM system helps firms store and process information about customers, triggering common learning processes. The ERP system helps firms manage their financial, manufacturing, operations, reporting, and human resources departments.

References

Alegre, J. and Chiva, R. (2008), "Assessing the impact of organizational learning capability on product innovation performance: an empirical test", *Technovation*, Vol. 28 No. 6, pp. 315-326, available at: http://linkinghub.elsevier.com/retrieve/pii/S0166497207001320 (accessed March 25, 2017).

Almeida, P. and Kogut, B. (1999), "Localization of knowledge and the mobility of engineers in regional networks", *Management Science*, Vol. 45 No. 7, pp. 905-917.

Arvanitis, S. (2005), "Computerization, workplace organization, skilled labour and firm productivity: evidence for the Swiss business sector", *Economics of Innovation and New Technology*, Vol. 14 No. 4, pp. 225-249, available at: www.tandfonline.com/doi/abs/10.1080/1043859042000226257

Audretsch, D.B. and Feldman, M.P. (1996), "R&D spillovers and the geography of innovation and production", *American Economic Review*, Vol. 86 No. 3, pp. 630-640, available at: www.jstor.org/stable/2118216

Balland, P.A., Belso-Martínez, J.A. and Morrison, A. (2016), "The dynamics of technical and business knowledge networks in industrial clusters: embeddedness, status or proximity?", *Economic Geography*, Vol. 92 No. 1, pp. 35-60, available at: www.tandfonline.com/doi/abs/10.1080/00130095.2015.1094370

Baptista, R. and Swann, P. (1998), "Do firms in clusters innovate more?", *Research Policy*, Vol. 27 No. 5, pp. 525-540.

Bathelt, H. (2008), "Clusters and regional development: critical reflections and explorations", *Economic Geography*, Vol. 84, pp. 109-112, available at: http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=29962761&lang=es&site=ehost-live

Belso-Martínez, J.A., Mas-Tur, A. and Roig-Tierno, N. (2017), "Synergistic effects and the co-existence of networks in clusters", *Entrepreneurship & Regional Development*, Vol. 29 Nos 1-2, pp. 137-154.

Biggiero, L. and Sammarra, A. (2010), "Does geographical proximity enhance knowledge exchange? The case of the aerospace industrial cluster of centre Italy", *International Journal of Technology Transfer & Commercialisation*, Vol. 9 No. 4, pp. 283-305, doi: 10.1504/IJTTC.2010.035397.

Boschma, R.A. and ter Wal, A.L.J. (2007), "Knowledge networks and innovative performance in an industrial district: the case of a footwear district in the South of Italy", *Industry & Innovation*, Vol. 14 No. 2, pp. 177-199, doi: 10.1080/13662710701253441.

Bourke, J. and Crowley, F. (2015), "The role of Hrm and Ict complementarities in firm innovation: evidence from transition economies", *International Journal of Innovation Management*, Vol. 19 No. 5, pp. 5401-5425, doi: 10.1142/S1363919615500541.

Cabello Medina, C., López Cabrales, A. and Valle Cabrera, R. (2011), "Leveraging the innovative performance of human capital through HRM and social capital in Spanish firms", *International Journal of Human Resource Management*, Vol. 22 No. 4, pp. 807-828, available at: www.scopus.com/record/display.uri?eid=2-s2.0-79952940377&origin=SingleRecordEmailAlert&txGid=ymEty2MWDgC6yT1acTUu7Yj%3A7

Camelo-Ordaz, C., Fernández-Alles, M.D.L.L. and Valle-Cabrera, R. (2008), "Top management team's vision and human resources management practices in innovative Spanish companies", *The International Journal of Human Resource Management*, Vol. 19 No. 4, pp. 620-638.

Capello, R. and Faggian, A. (2005), "Collective learning and relational capital in local innovation processes", *Regional Studies*, Vol. 39 No. 1, pp. 75-87.

Chen, C.-J. and Huang, J.-W. (2009), "Strategic human resource practices and innovation performance – the mediating role of knowledge management capacity", *Journal of Business Research*, Vol. 62 No. 1, pp. 104-114, available at: www.sciencedirect.com/science/article/pii/S0148296308000192%5Cnhttp://dx.doi.org/10.1016/j.jbusres.2007.11.016

Choi, M. and Yoon, H.J. (2015), "Training investment and organizational outcomes: a moderated mediation model of employee outcomes and strategic orientation of the HR function", *The International Journal of Human Resource Management*, Vol. 26 No. 20, pp. 2632-2651, available at: www.tandfonline.com/doi/full/10.1080/09585192.2014.1003084 (accessed March 28, 2017).

Chow, I.H.-S., Teo, S.T.T. and Chew, I.K.H. (2013), "HRM systems and firm performance: the mediation role of strategic orientation", *Asia Pacific Journal of Management*, Vol. 30 No. 1, pp. 53-72.

Clarkson, M., Fink, M. and Kraus, S. (2007), "Industrial clusters as a factor for innovative-drive in regions of transformation and structural change: a comparative analysis of East-Germany and Poland", *Journal of East European Management Studies*, Vol. 14 No. 4, pp. 340-364.

Coff, R. and Kryscynski, D. (2011), "Drilling for micro-foundations of human capital-based competitive advantages", *Journal of Management*, Vol. 37 No. 5, pp. 1429-1443, available at: http://jom.sagepub.com/cgi/doi/10.1177/0149206310397772

Cohen, W.M. and Levinthal, D.A. (1990), "Absorptive capacity: a new perspective on learning and innovation", *Administrative Science Quarterly*, Vol. 35 No. 1, pp. 128-152, doi: 10.2307/2393553.

Collins, C.J. and Clark, K.D. (2003), "Strategic human resource practices, top management team social networks, and firm performance: The role of human resource practices in creating", *Academy of Management Journal*, Vol. 46 No. 6, pp. 740-751.

Colombo, M.G. and Delmastro, M. (2008), *The Economics of Organizational Design: Theoretical Insights and Empirical Evidence*, Palgrave Macmillan, New York, NY, doi: 10.1057/9780230582200.

Colombo, M.G. and Grilli, L. (2005), "Founders' human capital and the growth of new technology-based firms: a competence-based view", *Research Policy*, Vol. 34 No. 6, pp. 795-816, doi: 10.1016/j.respol.2005.03.010.

Cooke, F.L. and Saini, D.S. (2010), "(How) does the HR strategy support an innovation oriented business strategy? An investigation of institutional context and organizational practices in Indian firms", *Human Resource Management*, Vol. 49 No. 3, pp. 377-400.

Davenport, T.O. (1999), *Human Capital: what it is and why People Invest it*, The Jossey-Bass business & management series, San Francisco, CA.

Delgado, M., Porter, M.E. and Stern, S. (2014), "Clusters, convergence, and economic performance", *Research Policy*, Vol. 43 No. 10, pp. 1785-1799.

De Noni, I., Ganzaroli, A. and Orsi, L. (2017), "The impact of intra- and inter-regional knowledge collaboration and technological variety on the knowledge productivity of European regions", *Technological Forecasting and Social Change*, Vol. 117, April, pp. 108-118, doi: 10.1016/j.techfore.2017.01.003.

Edelman, L.F., Brush, C.G. and Manolova, T. (2005), "Co-alignment in the resource-performance relationship: Strategy as mediator", *Journal of Business Venturing*, Vol. 20 No. 3, pp. 359-383.

Eggers, F., Kraus, S. and Covin, J.G. (2014), "Traveling into unexplored territory: radical innovativeness and the role of networking, customers, and technologically turbulent environments", *Industrial Marketing Management*, Vol. 43 No. 8, pp. 1385-1393.

Ennen, E. and Richter, A. (2010), "The whole Is more than the sum of its parts – or is it? A review of the empirical literature on complementarities in organizations", *Journal of Management*, Vol. 36 No. 1, pp. 207-233.

Falk, M. and Biagi, F. (2016), "Relative demand for highly skilled workers and use of different ICT technologies", *Applied Economics*, Vol. 6846, September, pp. 1-12, doi: 10.1080/00036846.2016.1208357.

Felin, T. and Hesterly, W.S. (2007), "The knowledge-based view, nested heterogeneity, and new value creation: philosophical considerations on the locus of knowledge", *Academy of Management Review*, Vol. 32 No. 1, pp. 195-218, doi: 10.5465/AMR.2007.23464020.

Finnegan, D.J. and Currie, W.L. (2010), "A multi-layered approach to CRM implementation: an integration perspective", *European Management Journal*, Vol. 28 No. 2, pp. 153-167.

Forsman, H. (2011), "Innovation capacity and innovation development in small enterprises: a comparison between the manufacturing and service sectors", *Research Policy*, Vol. 40 No. 5, pp. 739-750.

Foss, N.J. *et al.* (2009), "Encouraging knowledge sharing among employees: how job design matters", *Human Resource Management*, Vol. 48 No. 6, pp. 871-893.

Gertler, M.S. (2003), "Tacit knowledge and the economic geography of context, or the undefinable tacitness of being (there)", *Journal of Economic Geography*, Vol. 3 No. 1, pp. 75-99, doi: 10.1093/jeg/3.1.75.

Giuliani, E. (2007), "The selective nature of knowledge networks in clusters: evidence from the wine industry", *Journal of Economic Geography*, Vol. 7 No. 2, pp. 139-168, available at: http://joeg.oxfordjournals.org/cgi/doi/10.1093/jeg/lbl014 (accessed May 4, 2014).

Giuliani, E. (2013), "Network dynamics in regional clusters: evidence from Chile", *Research Policy*, Vol. 42 No. 8, pp. 1406-1419, available at: http://linkinghub.elsevier.com/retrieve/pii/S0048733313000796

Giuliani, E. and Bell, M. (2005), "The micro-determinants of meso-level learning and innovation: evidence from a Chilean wine cluster", *Research Policy*, Vol. 34 No. 1, pp. 47-68, available at: http://linkinghub.elsevier.com/retrieve/pii/S0048733304001441 (accessed April 29, 2014).

Granovetter, M.S. (2005), "The impact of social structure on economic outcomes mark granovetter", *Journal of Economic Perspectives*, Vol. 19 No. 1, pp. 33-50.

Grant, R.M. (1996), "Toward a knowledge-based view of the firm", *Strategic Management Journal*, Vol. 17 No. 52, pp. 109-122, doi: 10.2307/2486994.

Hidalgo Pérez, M.A., Ókean Alonso, J.M. and Rodríguez López, J. (2016), "Labor demand and ICT adoption in Spain", *Telecommunications Policy*, Vol. 40 No. 5, pp. 450-470.

Hollenstein, H. (2004), "Determinants of the adoption of information and communication technologies (ICT)", *Structural Change and Economic Dynamics*, Vol. 15 No. 3, pp. 315-342, available at: www.sciencedirect.com/science/article/pii/S0954349X04000177

Hsu, M.-S., Lai, Y.-L. and Lin, F.-J. (2014), "The impact of industrial clusters on human resource and firms performance", *Journal of Modelling in Management*, Vol. 9 No. 2, pp. 141-159, available at: www.scopus.com/inward/record.uri?eid=2-s2.0-84936746123&partnerID=40&md5=185e60c2626aab573b2fcf9d86d37ffe

Huselid, M.A., Jackson, S.E. and Schuler, R.S. (1997), "Technical and strategic human resources management effectiveness as determinants of firm performance", *Academy of Management Journal*, Vol. 40 No. 1, pp. 171-188, available at: http://amj.aom.org/cgi/doi/10.2307/257025 (accessed March 25, 2017).

Iammarino, S. and McCann, P. (2006), "The structure and evolution of industrial clusters: transactions, technology and knowledge spillovers", *Research Policy*, Vol. 35 No. 7, pp. 1018-1036, doi: 10.1016/j.respol.2006.05.004.

Kraus, S., Reiche, B.S. and Reschke, C.H. (2007), "Implications of strategic planning in SMEs for international entrepreneurship research and practice", *European Research and Practice*, Vol. 32 No. 6, pp. 110-127.

Knoben, J. and Oerlemans, L.A.G. (2012), "Configurations of inter-organizational knowledge links: does spatial embeddedness still matter?", *Regional Studies*, Vol. 46 No. 8, pp. 1005-1021, doi: 10.1080/00343404.2011.600302.

Lane, P.J. and Lubatkin, M. (1998), "Relative absorptive capacity and interorganizational learning", *Strategic Management Journal*, Vol. 19 No. 5, pp. 461-477, doi: 10.1002/(SICI)1097-0266(199805)19:5 < 461::AID-SMJ953 > 3.0.CO;2-L.

Laursen, K. (2002), "The importance of sectoral differences in the application of complementary HRM practices for innovation performance", *International Journal of the Economics of Business*, Vol. 9 No. 1, pp. 139-156, available at: www.cbs.dk/departments/ivs/laursen/

Laursen, K. and Foss, N.J. (2003), "New human resource management practices, complementarities and the impact on innovation performance", *Cambridge Journal of Economics*, Vol. 27 No. 2, pp. 243-263, available at: https://academic.oup.com/cje/article-lookup/doi/10.1093/cje/27.2.243 (accessed March 25, 2017).

Laursen, K. and Foss, N.J. (2014), "Human resource management practices and innovation", in Dodgson, M., Gann, D. and Phillips, N. (Eds), *The Oxford Handbook of Innovation Management*, Oxford University Press, Oxford, pp. 1-44, doi: 10.1093/oxfordhb/9780199694945.013.009.

Lengnick-Hall, M.L., Lengnick-Hall, C.A., Andrade, L.S. and Drake, B. (2009), "Strategic human resource management: the evolution of the field", *Human Resource Management Review*, Vol. 19 No. 2, pp. 64-85, doi: 10.1016/j.hrmr.2009.01.002.

Leonard, D. and Swap, W. (2000), "Gurus in the garage", *Harvard Business Review*, Vol. 78 No. 6, pp. 71-73, 76.

Lepak, D.P. and Snell, S.A. (2002), "Examining the human resource architecturew: the relationships among human capital, employment, and human resource configurations", *Journal of Management*, Vol. 28 No. 4, pp. 517-543, doi: 10.1016/S0149-2063(02)00142-3.

Lepak, D.P., Liao, H., Chung, Y. and Harden, E.E. (2006), "A conceptual review of human resource management systems in strategic human resource management research", in Martocchio, J.J. (Ed.), *Research in Personnel and Human Resources Management*, Emerald Group Publishing Limited, Bingley, pp. 217-271, doi: 10.1016/S0742-7301(06)25006-0.

Lund Vinding, A. (2004), "Human resources; absorptive capacity and innovative performance", in Christensen, J. and Lundvall, B. (Eds), *Product Inovation, Interactive Learning and Economic Performance*, Emerald Group Publishing Limited, Bingley, pp. 155-178, doi: doi:10.1016/S0737-1071(04)08007-2.

Malmberg, A. and Maskell, P. (2006), "Localized learning revisited", *Growth and Change*, Vol. 37 No. 1, pp. 1-18, doi: 10.1111/j.1468-2257.2006.00302.x.

March, J.G. (1991), "Exploration and exoploitation in organizational learning", *Organization Science*, Vol. 2 No. 1, pp. 71-87.

Maskell, P. and Malmberg, A. (1999), "Localised learning and industrial competitiveness", *Cambridge Journal of Economics*, Vol. 23, pp. 167-185, available at: www.scopus.com/inward/record.url?eid=2-s2.0-0032903443&partnerID=tZOtx3y1

Mesquita, L.F. (2007), "Starting over when the bickering never ends: rebuilding aggregate trust among clustered firms through trust facilitators", *Academy of Management Review*, Vol. 32 No. 1, pp. 72-91.

Minbaeva, D., Foss, N. and Snell, S. (2009), "Bringing the knowledge perspective into HRM", *Human Resource Management*, Vol. 48 No. 4, pp. 477-483, doi: 10.1002/hrm.20303.

Minbaeva, D., Pedersen, T., Bjorkman, I., Fey, C.F. and Park, H.J. (2003), "MNC knowledge transfer, subsidiary absorptive capacity, and HRM", *Journal of International Business Studies. Academy of International Business*, Vol. 34 No. 6, pp. 586-599.

Murovec, N. and Prodan, I. (2009), "Absorptive capacity, its determinants, and influence on innovation output: cross-cultural validation of the structural model", *Technovation*, Vol. 29 No. 12, pp. 859-872.

Muscio, A. (2007), "The impact of absorptive capacity on SMEs' collaboration", *Economics of Innovation and New Technology*, Vol. 16 No. 8, pp. 653-668.

Nelson, R.R. and Winter, S.G. (1982), *An Evolutionary Theory of Economic Change*, Harvard College, Boston, MA, doi: 10.2307/2232409.

Nonaka, I. and Takeuchi, H. (1995), *Knowledge-Creating Company*, pp. 3-19.

Nonaka, I. and Von Krogh, G. (2009), "Tacit knowledge and knowledge conversion: controversy and advancement in organizational knowledge creation theory", *Organization Science*, Vol. 20 No. 3, pp. 635-652, doi: 10.1287/orsc.1080.0412.

Østergaard, C.R., Timmermans, B. and Kristinsson, K. (2011), "Does a different view create something new? The effect of employee diversity on innovation", *Research Policy*, Vol. 40 No. 3, pp. 500-509.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y. and Podsakoff, N.P. (2003), "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, pp. 879-903, doi: 10.1037/0021-9010.88.5.879.

Ponds, R., van Oort, F. and Frenken, K. (2010), "Innovation, spillovers and university-industry collaboration: an extended knowledge production function approach", *Journal of Economic Geography*, Vol. 10 No. 2, pp. 231-255, doi: 10.1093/jeg/lbp036.

Porter, M.E. (1998), "Clusters and the new economics of competition", *Harvard Business Review*, Vol. 76, November-December, pp. 77-90, doi: 10.1042/BJ20111451.

Porter, M.E. (2008), *On Competition, Updated and Expanded Edition*, Harvard Business School Publishing, Boston, MA.

Preacher, K.J. and Hayes, A.F. (2008), "Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models", *Behavior Research Methods*, Vol. 40 No. 3, pp. 879-891.

Presutti, M., Boari, C., Majocchi, A. and Molina-Morales, X. (2017), "Distance to customers, absorptive capacity, and innovation in high-tech firms: the dark face of geographical proximity", *Journal of Small Business Management*, February, doi: 10.1111/jsbm.12323.

Ritter, T. and Gemünden, H.G. (2003), "Network competence: its impact on innovation success and its antecedents", *Journal of Business Research*, Vol. 56 No. 9, pp. 745-755.

Rodan, S. and Galunic, C. (2004), "More than network structure: how knowledge heterogeneity influences managerial performance and innovativeness", *Strategic Management Journal*, Vol. 25 No. 6, pp. 541-562.

Roessl, D., Fink, M. and Kraus, S. (2010), "Are family firms fit for innovation? Towards an agenda for empirical research", *International Journal of Entrepreneurial Venturing*, Vol. 2 Nos 3-4, pp. 366-380.

Roper, S., Du, J. and Love, J.H. (2008), "Modelling the innovation value chain", *Research Policy*, Vol. 37 Nos 6-7, pp. 961-977.

Roper, S., Love, J.H. and Bonner, K. (2017), "Firms' knowledge search and local knowledge externalities in innovation performance", *Research Policy*, Vol. 46 No. 1, pp. 43-56, doi: 10.1016/j.respol.2016.10.004.

Sammarra, A. and Biggiero, L. (2008), "Heterogeneity and specificity of inter-firm knowledge flows in innovation networks", *Journal of Management Studies*, Vol. 45 No. 4, pp. 800-829.

Saridakis, G., Lai, Y. and Cooper, C.L. (2016), "Exploring the relationship between HRM and firm performance: a meta-analysis of longitudinal studies", *Human Resource Management Review*, Vol. 27 No. 1, pp. 87-96, doi: 10.1016/j.hrmr.2016.09.005.

Soo, C., Tian, A.W., Teo, S.T.T. and Cordery, J. (2017), "Intellectual capital-enhancing HR, absorptive capacity, and innovation", *Human Resource Management*, Vol. 56 No. 3, pp. 431-454, doi: 10.1002/hrm.21783.

Teece, D.J. (2007), "Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance", *Strategic Management Journal*, Vol. 28 No. 13, pp. 1319-1350, doi: 10.1002/smj.640.

Todtling, F., Asheim, B. and Boschma, R. (2013), "Knowledge sourcing, innovation and constructing advantage in regions of Europe", *European Urban and Regional Studies*, Vol. 20 No. 2, pp. 161-169, available at: http://eur.sagepub.com/content/20/2/161.extract (accessed May 23, 2016).

Toulemonde, E. (2006), "Acquisition of skills, labor subsidies, and agglomeration of firms", *Journal of Urban Economics*, Vol. 59 No. 3, pp. 420-439.

Vanhaverbeke, W., Chesbrough, H. and West, J. (2014), "*Surfing the new wave of open innovation research", *New Frontiers in Open Innovation*, pp. 281-294.

Vidal-Salazar, M., Hurtado-Torres, N. and Matías-Reche, F. (2012), "Training as a generator of employee capabilities", *The International Journal of Human Resource Management*, Vol. 23 No. 13, pp. 2680-2697, doi: 10.1080/09585192.2011.610971.

Vinding, A.L. (2006), "Absorptive capacity and innovative performance: a human capital approach", *Economics of Innovation & New Technology*, Vol. 15 No. 4, pp. 507-517, doi: 10.1080/10438590500513057.

Weng, Q. and McElroy, J.C. (2010), "HR environment and regional attraction: an empirical study of industrial clusters in China", *Australian Journal of Management*, Vol. 35 No. 3, pp. 245-263, available at: www.scopus.com/inward/record.url?eid=2-s2.0-79251496125&partnerID=40&md5=9780fc84ba1c8423447c956d63af7f15

West, J., Salter, A., Vanhaverbeke, W. and Chesbrough, H. (2014), "Open innovation: the next decade", *Research Policy*, Vol. 43 No. 5, pp. 805-811, doi: 10.1016/j.respol.2014.03.001.

Zand, F. (2010), "Enterprise systems adoption and firm performance in Europe: the role of innovation", *AMCIS 2010 Proceedings, Lima*, pp. 12-15.

Corresponding author
Norat Roig-Tierno can be contacted at: norat.roig@esic.edu