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Key knowledge management processes for innovation: a systematic literature review

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Abstract

Purpose – The purpose of this paper is to review current literature on knowledge management processes considering the relationship between the key knowledge processes of acquisition, sharing, storage, codification, creation, application and different types of innovation, through a systematic literature review.

Design/methodology/approach – This study follows systematic review protocols for management and organisational sciences and analyses 45 full papers on knowledge management processes and innovation.

Findings – Results not only show that all knowledge processes can directly support innovation but also that other organisational variables (e.g. organisational learning, absorptive capacity) mediate this relationship. Moreover, knowledge creation and knowledge application appear as two central processes through which knowledge acquisition, sharing, codification and storage influence innovation. Knowledge acquisition and knowledge sharing are the most frequently studied knowledge processes. The majority of the sample papers present traditional innovation definitions (product vs process, radical vs incremental and technical vs administrative). However, organisational innovation, innovation capability and innovation performance approaches emerge from the papers' analysis.

Research limitations/implications – The present review includes major scientific papers; however, the search is limited to the Web of Science™ platform.

Originality/value – This literature review analyses high-quality, peer-reviewed papers, following a systematic methodology that can be tested and updated. Papers were divided based upon the knowledge process(es) being analysed and the innovation type/approach, providing a twofold contribution to knowledge management and innovation literature.

Keywords Systematic literature review, Innovation, Absorptive capacity, Knowledge management, Knowledge processes

Paper type Literature review



1. Introduction

The knowledge-based view of the firm recognises the importance of knowledge as the main source of competitive advantage, and emphasise the firm's role as an "institution for the production of goods and services" (Grant, 1996, p. 120). In fact, organisations need to reconfigure products and practices to stay viable (Alavi and Leidner, 2001; Davenport and Prusak, 1998). Thus, this constantly need for

differentiated products and services calls for (continuous) innovation and a “well-planned system of knowledge management” (Popadiuk and Choo, 2006, p. 302).

Therefore, knowledge provides firms with a sustained competitive advantage through its application in new or significantly improved products/services, production processes, managerial practices and marketing strategies, that is, innovation (Ceylan, 2013; Weerawardena, 2003a). Considering the need to understand the links between knowledge and innovation, several researchers explored the relationship between knowledge processes and innovation outcomes. Such interest raises the need for a systematic review of relevant literature that can provide an up-to-date understanding of the research field.

By aggregating theoretical and empirical current papers, the present systematic literature review (SLR) aims to answer to the following general research question:

RQ1: What are the current research main findings regarding the knowledge management processes (KMPs)–innovation relationship?

Four sub questions are also addressed by this paper:

RQ1a. Which KMPs are studied by current research considering its relationship with innovation?

RQ1b. Which methods were used by the sample papers?

RQ1c. Which variables play a mediation role in KMP–innovation research?

RQ1d. Which innovation types are considered?

Following SLR protocols for management and organisational sciences (Denyer and Tranfield, 2009; Tranfield *et al.*, 2003), this work focus on specific KMPs and innovation, shedding light on these relationships by examining six key KMPs:

- (1) knowledge acquisition;
- (2) knowledge storage;
- (3) knowledge codification;
- (4) knowledge sharing;
- (5) knowledge application; and
- (6) knowledge creation.

Based on a group of 45 papers (41 empirical papers and 4 theoretical contributions), the authors analyse and discuss the influence of these KMP on different innovation types. This paper focuses on innovation framed within the knowledge management literature and considers innovation to be a knowledge-based outcome. The remainder of the paper is organised as follows. Section 2 explores the relationship between the innovation and knowledge management literature; Section 3 highlights the methodological steps of the systematic review; the results from the analysis of the sample papers are presented in Section 4; finally, Sections 5 and 6 discuss the research results and provide further research suggestions, respectively.

2. Knowledge management and innovation

Organisations can innovate, through serendipity, without formally managing knowledge but this haphazard cannot compete with dynamic environments and the need to “innovate fast enough, often enough and efficiently” (Demarest, 1997, p. 382). In fact, knowledge management plays an invaluable role in innovation through diverse means like facilitating collaboration, assisting in tacit knowledge conversion into explicit knowledge, identifying knowledge gaps and ensuring that knowledge is available and accessible (Du Plessis, 2007). Therefore, knowledge management researchers have investigated the relationship between knowledge and innovation (Boer *et al.*, 2001; Darroch and McNaughton, 2002; Darroch, 2005; Gopalakrishnan and Bierly, 2001; Sousa, 2006; Xu *et al.*, 2010), and in particular concentrate on the role of knowledge creation as a prerequisite for innovation (Esterhuizen *et al.*, 2012; Kogut and Zander, 1992; Nonaka, 1991; Popadiuk and Choo, 2006; Quintane *et al.*, 2011). Further, knowledge usage is another core activity, and it must follow knowledge creation to leverage continuous innovation (Xu *et al.*, 2010; 2011). Even being critical to innovation, the processes of knowledge creation and knowledge application may depend on other processes such as acquisition, sharing and codification, to positively influence innovation outcomes (Andreeva and Kianto, 2011; Chen and Huang, 2009; Li *et al.*, 2009; Zhou and Li, 2012).

Whereas, that the importance of the KMP for innovation is substantiated, we must understand what innovation is, and what innovation types the literature has predominantly identified. Innovation literature is widespread throughout different research fields (Gopalakrishnan and Damanpour, 1997), which generates different conceptual approaches that have been theoretically framed. Therefore, innovation reviews (Damanpour and Daniel Wischnevsky, 2006; Damanpour, 2010; Gopalakrishnan and Bierly, 2001; Gopalakrishnan and Damanpour, 1997; Prajogo and Sohal, 2003) frequently distinguish between innovation type – product/service vs process, radical vs incremental and technical vs administrative. Considering the organisational field, an innovation can be defined as “the development and use of new ideas or behaviors” (Damanpour and Daniel Wischnevsky, 2006, p. 271). Other authors argue that an idea is not, by itself, an innovation, and that it must first be “developed and transformed into a product, process, or service” that can be commercialised (Popadiuk and Choo, 2006, p. 303). In conclusion, the multiple definitions show a lot of diversity in innovation conceptualisation, and the need to clearly differentiate which type of innovation is being addressed.

3. Methodology

The present section describes how the authors collected the papers and refined the results to achieve a sample of valuable references to work on. SLR protocols for organisational sciences guided the methodological steps (Denyer and Tranfield, 2009; Tranfield *et al.*, 2003).

3.1 Search strategy

The search strategy for this SLR started with the identification of keywords to build a search string. This is an important step, as keywords determine which papers the database will retrieve. Following relevant works in the field of knowledge management (KM) (Gold *et al.* 2001; Heisig, 2009; Hislop, 2009; Xu *et al.*, 2010), as well as a scoping

study, six key processes were selected for this review. Hence, the authors considered the KMP of acquisition, creation, storage, codification, sharing and application. These processes represent some of the most discussed KM activities (Heisig, 2009) and are relevant KMP for innovation, reflecting the physical, human and technological view of KM research (Xu *et al.*, 2010).

With the final search string[1], the authors performed a search on September 1, using the Web of Science™ platform to select two databases (Science Citation Index Expanded and Social Sciences Citation Index). In all, 335 papers were collected from a period ranging from 2009 to September 2014. The review only considered articles and reviews (document type), narrowing our selection to 324 papers, 315 of which are in English. Table I shows the top ten sources. Relevant journals in the KM and innovation fields are included. These ten sources account for 32.08 per cent of all papers, showing the consistency between the search strategy and the results.

Forty-eight of the 315 papers were selected after title and abstract analysis and the application of inclusion/exclusion criteria (Appendix A1). After gaining full access to the selected papers, we use 45 papers for the final sample. Figure 1 synthesises the search and refinement steps.

4. Results

4.1 Papers' methodology

The analysis of the sample papers shows that empirical studies are dominant in KMP-innovation recent research (41 of 45 papers), with only four papers of our sample providing theoretical developments. Tables II and III provide a detailed grid that classifies the 41 empirical contributions considering studies' methodology as well as the KMP, and innovation type(s). Papers were analysed and coded using Nvivo software. The definitions provided in each study were coded considering pre-established innovation conceptualisations.

Source title	Counts	(%) of 315
<i>Journal of Knowledge Management</i>	23	7.30
<i>International Journal of Technology Management</i>	16	5.08
<i>Research Policy</i>	14	4.44
<i>Innovation Management Policy Practice</i>	9	2.86
<i>Journal of Business Research</i>	8	2.54
<i>Technovation</i>	7	2.22
<i>Technological Forecasting and Social Change</i>	6	1.91
<i>Knowledge Management Research Practice</i>	6	1.91
<i>Journal of Product Innovation Management</i>	6	1.91
<i>African Journal of Business Management</i>	6	1.91

Table I.
Top ten sources
considering citation
counts

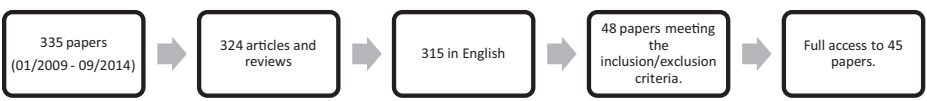


Figure 1.
Steps for results'
refinement

Table II.
Classification of
quantitative papers

Author(s), publication date (sorted by year)	Acquisition	KMP		Service/ product innovation	Process innovation	Radical innovation	Incremental innovation	Innovation			Innovation performance	Other
		Creation/ generation	Codification/ storage					Sharing	Application	Technical innovation		
Chen and Huang (2009)	X			X				X	X			
Garcia-Muina <i>et al.</i> (2009)		X						X	X			
Hu <i>et al.</i> (2009)				X								
Huang and Li (2009)	X			X				X				
Li <i>et al.</i> (2009)				X				X				
Hung <i>et al.</i> (2010)				X								
Liao and Wu (2010)	X	X		X	X							
Liao <i>et al.</i> (2010)	X		X	X								
Maurer (2010)	X			X						X		
Zhang <i>et al.</i> (2010)	X	X										X
Alegre <i>et al.</i> (2011)		X										X
Andreeva and Kianto (2011)	X	X		X								X
Camelo-Ordaz <i>et al.</i> (2011)		X		X								
Kianto (2011)	X	X	X									
Zheng <i>et al.</i> (2011)	X	X										X
Hu <i>et al.</i> (2012)				X	X							
Kumar and Rose (2012)		X		X	X							
Liao <i>et al.</i> (2012)	X									X		
Lin <i>et al.</i> (2012)	X	X		X	X							
Martinez-Canas <i>et al.</i> (2012)	X			X	X							
Marvel (2012)	X					X						
Saenz <i>et al.</i> (2012)				X								
Shu <i>et al.</i> (2012)				X	X							
Wang and Wang (2012)		X								X		
Zhou and Li (2012)	X	X		X		X						
Lee <i>et al.</i> (2013)	X		X	X				X				
Parra-Requena <i>et al.</i> (2013)	X			X								
Wong (2013)				X	X							
Zelaya-Zamora and Senoo (2013)		X		X								X
Abdelmagid (2014)	X			X				X				
Hu and Randel (2014)		X		X					X			X
Lai <i>et al.</i> (2014)	X		X	X								X
Maes and Sels (2014)				X		X						
Molina-Morales <i>et al.</i> (2014)				X								
Soto-Acosta <i>et al.</i> (2014)	X			X	X							X

[Author(s), publication date sorted by year]	KMP				Innovation											
	Methodology	Acquisition	Creation/ generation	Codification/ storage	Sharing	Application	Service/ product innovation	Process innovation	Radical innovation	Incremental innovation	Technical innovation	Administrative innovation	Organisational innovation	Innovation capability	Innovation performance	Other
Taminiau <i>et al.</i> , (2009)	EX				X		X									
Spaeth <i>et al.</i> (2010)	EX		X				X									X
Iacono <i>et al.</i> (2012)	QL		X				X		X							
Xu <i>et al.</i> (2012)	EX,QN	X				X					X					
Connell <i>et al.</i> (2014)	QL				X											X
Pattinson and Preece (2014)	QL	X			X				X		X					
Notes: EX = Explorative; QL = Qualitative; QN = Quantitative																

Table III.
Classification of
qualitative and
explorative papers

4.2 Knowledge management processes and innovation

4.2.1 Knowledge acquisition and innovation. Several past contributions have linked external knowledge acquisition to the innovation process (Zahra and George, 2002). Organisations engage in knowledge acquisition when they lack the internal resources to successfully innovate (Maes and Sels, 2014). In Table IV, the authors summarise the sample papers' contribution to the acquisition–innovation link. Knowledge acquisition is frequently studied considering its indirect effect on innovation outputs, being mediated by other organisational variables (Section 4.4.2).

On other hand, it seems to directly influence radical product/service innovation (Marvel, 2012), product innovation (Maurer, 2010) and new product performance (Molina-Morales *et al.*, 2014).

Knowledge acquisition is defined as “the process by which organisations obtain knowledge” (Molina-Morales *et al.*, 2014, p. 236), and it is studied by not only taking into account external sources of knowledge but also encompassing internal creation (Liao *et al.*, 2012), or several dimensions, such as technological knowledge, ways to serve markets, customer problems and market knowledge acquisition (Marvel, 2012).

Papers which study knowledge acquisition highlight related organisational themes like social capital (Martinez-Canas *et al.*, 2012; Molina-Morales *et al.*, 2014; Parra-Requena *et al.*, 2013), absorptive capacity (Liao *et al.*, 2010) and networks (Zheng *et al.*, 2011), focusing on external ties and the competition/cooperation dilemma (Zhang *et al.*, 2010).

4.2.2 Knowledge sharing and innovation. Knowledge sharing, which can be defined as “the act of placing knowledge possessed by an individual at the disposition of others within the organization” (Camelo-Ordaz *et al.*, 2011, p. 1444), plays a key role in innovation by directly influencing product innovation (Camelo-Ordaz *et al.*, 2011; Wong, 2013), radical innovation (Maes and Sels, 2014) and innovation capability (Saenz *et al.*, 2012). When shared through web platforms knowledge is also positively related to innovation (Soto-Acosta *et al.*, 2014). Table V summarises the sample papers' contributions to the knowledge sharing–innovation literature.

Despite the general definition presented above, some papers conceptualise knowledge sharing as comprising different dimensions, such as symbiosis, reputation and altruism (Hu *et al.*, 2009). Other papers consider different mechanisms that allow the sharing of knowledge, like information and communication technology, personal interaction and management processes (Saenz *et al.*, 2012).

The sample papers highlight research topics like team culture (Hu *et al.*, 2009) and affective commitment (Camelo-Ordaz *et al.*, 2011), showing the importance of commitment-based human resources practices (Soto-Acosta *et al.*, 2014), during this human-oriented stage. Absorptive capacity is related to knowledge sharing in Maes and Sels' (2014) paper, which demonstrates the importance of sharing knowledge to transform and exploit existing knowledge for innovation. Firm location in industry clusters with similar businesses (Connell *et al.*, 2014) and the construction of apprentice-based and intra-organisational communities of practice (Pattinson and Preece, 2014) also support knowledge sharing.

4.2.3 Knowledge codification and innovation. One paper from the sample examines knowledge codification's role on a sample of 54 companies in the Spanish biotech sector. The results underline the influence of knowledge codification on innovation, concluding

Author(s)	Sample	Innovation type	Main findings
Liao <i>et al.</i> (2010)	362 questionnaires from financial and manufacturing firms	Product, process and management innovation	Absorptive capacity is the mediator between KA and innovation capability
Liao <i>et al.</i> (2012)	449 questionnaires from 23 companies	Product, market, process, behavioral and strategic innovation	Organisational learning fully mediates the KA – innovation link
Martinez-Canas <i>et al.</i> (2012)	214 firms located inside science and technology parks	New product development	KA fully mediates the social capital – firm innovation relationship
Marvel (2012)	166 founders of new technology ventures	Radical product/service innovation	KA (customer problems and markets) is positively associated with innovation radicalness
Maurer (2010)	218 projects directed by 144 firms in the German engineering industry	Product innovation	KA from project partners positively influences product innovation
Molina-Morales <i>et al.</i> (2014)	224 Spanish footwear firms	New product performance	KA is positively associated to the innovative performance of the firm
Parra-Requena <i>et al.</i> (2013)	166 Spanish footwear firms	New product performance	Combinative capability positively moderates the KA – innovation relationship

Note: KA = Knowledge Acquisition

Table IV.
Literature on
knowledge
acquisition and
innovation

Table V.
Literature on
knowledge sharing
and innovation

Author(s)	Sample	Innovation type	Main findings
Camelo-Ordaz <i>et al.</i> (2011)	87 R&D departments of Spanish companies	Product innovation	KSH positively influence innovation
Connell <i>et al.</i> (2014)	4 Industry clusters located in Dubai and Australia	Collaborative innovation	Interaction between firms can promote KSH and foster innovation
Hu <i>et al.</i> (2009)	621 employees in 35 different international tourist hotels in Taiwan	Service innovation performance	Team culture moderates the relationship between KSH and service innovation
Hu and Randel (2014)	219 work teams, representing 1,012 team members	Team innovation	Tacit KSH fully mediates the relationship between explicit KSH and team innovation
Hu <i>et al.</i> (2012)	1,260 employees from 35 of Taiwan's international tourist hotels	Team service innovation performance	KSH – service innovation relationship is mediated by leader member exchange and team member exchange
Kumar and Rose (2012)	472 Administrative and Diplomatic Service Officers from Malaysian's public sector organisations	Innovation Capability	Islamic Work Ethic moderates the KSH – innovation relationship
Maes and Sels (2014)	194 Belgian SMEs	Radical innovation	KSH directly influences radical innovation
Saenz <i>et al.</i> (2012)	75 Spanish and 69 Columbian medium-high and high-technology firms	Innovation capability (new idea generation and innovation project management)	KSH (except ICT-based) is key to enhance innovation capability
Soto-Acosta <i>et al.</i> (2014)	535 Spanish SMEs	Innovation (new technological knowledge and ideas in new products and processes)	Web KSH positively contributes to innovation
Wang and Wang (2012)	89 high technology firms in Jiangsu (China)	Innovation speed	Explicit and tacit KSH practices facilitate innovation. Explicit KSH has more significant effects on innovation speed. Tacit KSH has more significant effects on innovation quality
Wong (2013)	203 green innovation project leaders from electronics manufacturers in China	Green product innovation; Green process innovation; New green product success	KSH positively influences green product/process innovation

Note: KSH = Knowledge sharing

that “the process of converting the codifiable tacit knowledge into messages” is beneficial to firms that are developing incremental innovations (Garcia-Muina *et al.*, 2009, p. 142).

4.2.4 Knowledge creation and innovation. The sample papers conceptualise knowledge creation in different manners. Shu *et al.* (2012) consider the two dimensions of knowledge exchange and knowledge combination, to test the influence of knowledge creation on product and process innovation. The results from a cross-sectional survey of 270 Chinese companies show that knowledge creation, particularly knowledge combination, positively influences product and process innovations. Zelaya-Zamora and Senoo (2013) see knowledge creation capability as a construct encompassing six dimensions (absorptive capacity, SECI performance, external ties, inter-unit ties, members’ commitment and cooperation and trust), which are positively and significantly associated with innovation performance. Spaeth *et al.* (2010, p. 423) case study analyses knowledge creation in the context of a push model of open innovation, which is defined as “knowledge creation by external contributors that is uncompensated by the firm but that pushes knowledge into the open innovation process”. Through examining explicit knowledge shared within discussion forums, the authors shed light on knowledge creation in open innovation, which is enhanced through “lowering the entry barriers for external participants who seek to join and contribute” (p. 427). Another case study by Iacono *et al.* (2012) draws attention to inter-organisational relationships for knowledge creation and product and process innovation in the context of temporary project networks.

4.2.5 Knowledge management processes and innovation. Sixteen papers from the sample study the relationship of more than one KMP with innovation. Table VI summarises nine of these contributions and the main conclusions concerning the KMP–innovation relationship. These papers provide empirical analysis, showing that KMP directly impact on innovation (Aboelmaged, 2014; Hung *et al.*, 2010; Lee *et al.*, 2013; Liao and Wu, 2010; Lin *et al.*, 2012; Xu *et al.*, 2012; Zhou and Li, 2012). KMPs also mediate the relationship between numerous organisational variables and innovation (Section 4.4.1)

4.2.6 Theoretical developments on knowledge management processes–innovation literature. Four papers theoretically discuss the impact and relationship of knowledge management and innovation (Alguezaui and Filieri, 2010; Esterhuizen *et al.*, 2012; Quintane *et al.*, 2011; Xu *et al.*, 2010). Esterhuizen *et al.* (2012) develop an innovation maturity model regarding Nonaka’s SECI model of knowledge creation. The authors argue that externalisation is the key action necessary to move from the limited innovation practices of maturity level 1, to maturity level 3, where the best innovation practices are identified and implemented. Thereafter, combination and internalisation will help organisations move from maturity Level 3 to Level 5, where practices are institutionalised and become natural behaviour. Finally, socialisation acts as an underlying process that supports innovation maturity growth across all five levels. The idea that knowledge creation is intrinsically related to innovation is shared by Quintane *et al.* (2011). In their work, they conceptualise innovation as useful new knowledge that can be duplicated and which is new to the context it is introduced to. Although knowledge creation is critical for innovation, organisations also need to use and apply existing knowledge to support innovation (Xu *et al.*, 2010). These key processes to innovation are complemented with acquisition, personalisation and sharing, and knowledge

Table VI.
Knowledge
management
processes and
innovation

Author(s)	Sample	KMP	Innovation type	Main findings
Andreeva and Kianto (2011)	221 companies from Finland, Russia and China	KC; KST; KSH; KA	Innovation performance (products/services, processes, management and marketing)	All KMP positively influence innovation
Chen and Huang (2009)	146 Taiwanese firms	KA; KSH; KAPP	Administrative innovation; Technical innovation	KMP directly influence innovation
Huang and Li (2009)	176 firms in Taiwan	KA; KSH; KAPP	Administrative innovation; Technical innovation	KMP positively influence innovation
Lee <i>et al.</i> (2013)	162 Malaysian manufacturing firms	KA; KSH; KAPP; KST	Technological innovation	KMP are positively and significantly related to technological innovation
Li <i>et al. et al.</i> (2009)	607 Chinese firms	KSH; KAPP	Technological innovation	The positive relationship between KSH and a firm's innovation is mediated by KAPP
Liao and Wu (2010)	327 Taiwanese companies (manufacturing and finance)	KA; KAPP	Product innovation, market innovation, process innovation, behavioral innovation and strategic innovation	Knowledge management is significantly and positively related to organisational innovation
Xu <i>et al.</i> (2012)	228 Chinese manufacturing firms	KA; KAPP	Technology innovation performance	KMP contribute to the enhancement of technological innovation performance
Zhang <i>et al.</i> (2010)	127 German firms engaged in strategic alliances	KA; KC	Innovative performance	KA's effect on innovation is mediated by KC
Zhou and Li (2012)	2 samples of 177/68 Chinese firms respectively	KSH; Market KA	Radical innovation	KSH is beneficial for innovation in broad knowledge bases. KA positively influences radical innovation in deep knowledge bases

Notes: KA = Knowledge acquisition; KC = Knowledge creation; KST = Knowledge storage; KSH = Knowledge sharing; KAPP = Knowledge application

refinement, creating a knowledge life cycle that leverages the innovation process. Tacit knowledge sharing with partners in cohesive and sparse networks is essential to incremental and radical innovation, respectively (Alguezaui and Filieri, 2010).

4.3 Innovation type

This section analyses the sample papers by innovation type, considering the established innovation categories of product/service and process innovation, radical and incremental innovation and administrative or technical innovation (Gopalakrishnan and Damanpour, 1997). The authors also consider papers where conceptualisation does not match these categories but provide a solid theoretical definition. The tables provided in Section 4.3 follow the terminology used by the papers in the innovation type row.

4.3.1 Product/service and process innovation. Fourteen papers empirically studied or theoretically developed product/service innovation. These papers consider different characteristics of product innovation such as new product performance (Molina-Morales *et al.*, 2014; Parra-Requena *et al.*, 2013) and product ergonomics (Iacono *et al.*, 2012). Diverse indicators, such as the new products count (Martinez-Canas *et al.*, 2012), the introduction of new products (Maurer, 2010), market share, sales, growth rate (Lin *et al.*, 2012) and the frequency of a products' renewal (Camelo-Ordaz *et al.*, 2011) are used to operationalise this type of innovation. Only three of the fourteen papers focus exclusively on service innovation. The development of new services and employee service innovation behaviour reflect service innovation performance (Hu *et al.*, 2009, 2012). A qualitative contribution was made to service innovation research by Taminiau *et al.* (2009, p. 43). The authors state that service innovation research faces different challenges when compared with product innovation because service innovation is "much more difficult to pinpoint", than innovation in manufacturing firms.

Four papers consider process innovation as a knowledge-based outcome. This innovation type is operationalised as the improvement in "manufacturing or operational processes" (Shu *et al.*, 2012, p. 133) and "the efficient use of energy, materials and resources" (Wong, 2013, p. 323), in relation to manufacturing and production processes.

4.3.2 Radical and incremental innovations. Incremental innovation is theoretically studied by Alguezaui and Filieri's (2010, p. 902) paper, which considers the contributions of social capital and specially sparse networks to the "minor changes to the firm's current products, services, processes, administrative or technical conditions", which are obtained through the integration and combination of different knowledge sources. This type of innovation can also benefit from knowledge acquisition in apprentice-based and intra-organisational communities of practice (Pattinson and Preece, 2014).

Radical innovation is consensually conceptualised as the significant improvement in companies' products/services, as well as new technological patterns, which alter consumption patterns in a market (Alguezaui and Filieri, 2010; Maes and Sels, 2014; Marvel, 2012; Zhou and Li, 2012). This is reflected in indicators used to measure this innovation type, for example, "Our product/service represents an entirely new type of product/service" (Marvel, 2012, p. 456).

4.3.3 Technical and administrative innovation. Three papers from our sample study administrative innovation (Aboelmaged, 2014; Chen and Huang, 2009; Huang and Li, 2009), which measure the degree of innovation in “planning procedures, process control systems, and integrated mechanisms” (Huang and Li, 2009, p. 294). In turn, technical innovation measures the extent to which companies develop technologies, incorporate them into new products and facilitate new processes to improve quality and lower costs (Chen and Huang, 2009; Huang and Li, 2009; Li *et al.*, 2009). Garcia-Muina *et al.* (2009) make a distinction between radical and incremental technical innovations based upon the diffusion of the technological knowledge used to produce the new product and/or process. Indicators used to assess firms’ technological innovation include the number of new products, the speed of new product development and the rate of success of the new product (Xu *et al.*, 2012).

4.3.4 Other innovation conceptualisations. Results highlight that, while traditional categories of innovation are frequently found, almost half of the sample papers (19 of 45) provide different definitions of innovation. Theoretical papers propose new definitions that see “innovation as the creation of new knowledge that is necessary to replicate the process leading to innovation outcomes” (Quintane *et al.*, 2011, p. 940), in addition to intrinsically relate the process of continuous innovation to KM and knowledge bases (Xu *et al.*, 2010). Empirical papers also provide theoretical developments to the innovation literature. In Kianto’s (2011) paper, continuous innovation encompasses the three factors of individual creativity, knowledge implementation and strategic flexibility. In turn, the combination of different activities (knowledge creation and utilisation) with the main actors in innovation (firms and external constituents) results in a new framework for open innovation (Spaeth *et al.*, 2010). Emphasising the importance of time for innovation, innovation speed is conceptualised as the time elapsed between initial development and ultimate commercialisation of products/services in Wang and Wang’s (2012) paper.

Three approaches to innovation emerge from the analysis of the remaining papers are as follows:

- (1) organisational innovation – these papers provide broad definitions of innovation, and they consider innovation as a construct encompassing product innovation, market innovation, behavioural innovation and strategic innovation, all as organisational innovation dimensions (Liao and Wu, 2010; Liao *et al.*, 2012);
- (2) innovation capability – the organisational means that generate innovative outputs (Esterhuizen *et al.*, 2012), encompass new idea generation and innovation project management (Saenz *et al.*, 2012) and affect innovation performance; and
- (3) innovation performance – the degree to which companies innovate in terms of products/services, processes, management and marketing (Andreeva and Kianto, 2011), to increase innovative outcomes (Zhang *et al.*, 2010; Zheng *et al.*, 2011) when compared with competitors (Zelaya-Zamora and Senoo, 2013). Innovation performance comprises market and product performance in Lai *et al.*’s (2014) conceptualisation and can be applied to team innovation performance as well (Hu and Randel, 2014).

4.4 Mediation results

Eighteen papers from the sample empirically analyse mediation effects between:

- KMP (as mediating variable), independent variables and innovation;
- KMP (as independent variable), mediating variables and innovation; and
- KMP (with some processes mediating the relationship between other processes and innovation).

4.4.1 Knowledge management processes as mediating variable. Eight papers empirically analyse the mediating role that KMP play between independent variables and innovation. Results are synthesised in [Table VII](#).

These papers, while analysing the mediating role of KMP, provide evidence that knowledge processes, more than directly influence innovation, can act as an intervening variable through which different dependent variables like social capital ([Martinez-Canas et al., 2012](#)) or strategic human resources practices ([Chen and Huang, 2009](#)) influence innovation.

4.4.2 Other mediating variables. Five papers analyse KMPs as independent variables, whose relationship with innovation is mediated by other organisational variables. [Table VIII](#) shows the results about the mediation effects.

The results show that, while knowledge processes are important and can directly affect innovation, dynamic learning capabilities ([Alegre et al., 2011](#); [Liao and Wu, 2010](#); [Liao et al., 2010](#)) are mediating this relationship.

4.4.3 Mediation effects between knowledge management processes. Finally, some authors provide interesting results about interactions between different KMPs. [Table IX](#) presents the results about mediation effects between KMPs, with some processes acting as mediators between other KMPs and innovation.

The full mediation results found by the analysed papers show that some knowledge processes exert their effect on innovation through other processes like the creation of new knowledge ([Andreeva and Kianto, 2011](#); [Zhang et al., 2010](#)) or its application ([Li et al., 2009](#)).

5. Discussion and conclusion

This SLR aims to discover which KMPs are frequently studied, considering its relationship with innovation, as well as to show and discuss the main findings of KMP–innovation literature. Results show that the knowledge processes are important to leverage innovation. However, each key KMP not only always directly influences innovation but also is mediated by other organisational variables. Particularly, knowledge acquisition seems to be more effective for innovation purposes when it is market-focused ([Darroch and McNaughton, 2002](#); [Lin et al., 2012](#); [Zhou and Li, 2012](#)). Otherwise, newly acquired knowledge may depend on organisational dynamic capabilities (e.g. absorptive capacity), organisational learning, combinative capabilities or other KMP like creation and application. Thereby, results suggest that knowledge is more likely to promote innovation results in organisations with high absorptive capacity and learning capabilities. Even more, they support [Xu et al.'s](#) (2010) review that emphasises the key role of knowledge creation and application. In fact, knowledge creation fully mediates the impact of other KMP on innovation ([Andreeva and Kianto, 2011](#); [Zhang et al., 2010](#)), while knowledge application mediates the relationship between knowledge sharing and innovation ([Li et al., 2009](#)). Thus, it seems that the impact that

Table VII.
KMP as mediators
between independent
variables and
innovation

Author(s)	Independent variable	Mediator variable	Mediation results
Chen and Huang (2009) Hu and Randel (2014)	Strategic human resources practices Extrinsic incentives for knowledge sharing	KM capacity (Acquisition; sharing; application) Tacit knowledge sharing	Full mediation occurs Partial mediation occurs
Huang and Li (2009)	Social interaction (trust; communication; coordination)	KM (acquisition; sharing; application)	Full mediation occurs
Lai <i>et al.</i> (2014)	Industry clusters	KM (Knowledge creation and acquisition; knowledge dissemination and storage)	Full mediation occurs
Lin <i>et al.</i> (2012)	Market orientation	Customer KM (acquisition; sharing; application)	Full mediation occurs
Martínez-Canas <i>et al.</i> (2012)	Social capital	Knowledge acquisition	Full mediation occurs
Molina-Morales <i>et al.</i> (2014)	Cognitive proximity	Knowledge acquisition	Partial mediation occurs
Shu <i>et al.</i> (2012)	Managerial ties	Knowledge creation (exchange and combination)	Full mediation occurs

Author(s)	Independent variable	Mediator variable	Mediation results
Alegre <i>et al.</i> (2011)	KM practices (dissemination; storage)	KM dynamic capabilities (internal and external learning competence)	Full mediation occurs
Hu <i>et al.</i> (2012)	Knowledge sharing	Leader-member exchange (LMX); Team-member exchange (TMX)	Partial mediation occurs
Hung <i>et al.</i> (2010)	KM initiatives (creation; storage; transfer; and application)	Total quality management practices	Full mediation occurs
Liao and Wu (2010)	KM (acquisition; conversion; application)	Organisational learning	Full mediation occurs
Liao <i>et al.</i> (2010)	Knowledge Acquisition	Absorptive capacity	Full mediation occurs

Table VIII.
Mediation variables
between KMP and
innovation

Table IX.
KMP as mediators
and independent
variables

Author(s)	Independent variable	Mediator variable	Mediation results
Andreeva and Kianto (2011)	Knowledge acquisition; knowledge sharing and application; knowledge storage and documentation	Knowledge creation	Full mediation occurs
Lee <i>et al.</i> (2013)	Knowledge acquisition	Knowledge sharing	Full mediation occurs
Li <i>et al.</i> (2009)	Knowledge sharing	Knowledge application	Full mediation occurs
Zhang <i>et al.</i> (2010)	Knowledge acquisition	Knowledge creation	Full mediation occurs
Zheng <i>et al.</i> (2011)	Knowledge acquisition; knowledge generation	Knowledge combination	Full mediation occurs

KMPs like acquisition, sharing and storage have on innovation happens through two central processes:

- (1) knowledge creation; and
- (2) knowledge application.

Knowledge sharing and knowledge acquisition are the most frequently studied KMP by empirical papers, considering the relationship with innovation. This is an interesting result considering that theoretical KM papers emphasise the role of knowledge creation and application for innovation (Esterhuizen *et al.*, 2012; Nonaka, 1991; Popadiuk and Choo, 2006; Quintane *et al.*, 2011; Xu *et al.*, 2010). However, this shows the current research's concern about external search and organisational networks to broaden and deepen the organisational knowledge base, as well as the need for human interaction for ideation and innovation purposes. Nevertheless, strengthening the knowledge base through external acquisition or internal knowledge creation provides a potential for innovation activities and outcomes. This potential innovation capacity is realised when knowledge is shared among individuals and units, and is subsequently applied, highlighting the importance of creating a knowledge sharing culture in organisations (Aboelmaged, 2014; He and Abdous, 2013).

Considering the innovation types in this study, this SLR concludes that normally innovation is defined in a narrow manner (Garcia and Calantone, 2002) and can become a buzzword. Hence, many authors use it in a paper's title and abstract, even when only a dimension of the overall construct is discussed by the paper (Parra-Requena *et al.*, 2013). However, other authors choose to identify the specific innovation type under study in the title of their papers (Garcia-Muina *et al.*, 2009; Maurer, 2010; G. N. Xu *et al.*, 2012). Regarding the different ways to measure innovation, we argue that the use of new product count (Zhang *et al.*, 2010) is a questionable way to measure innovative performance. As noticed by other authors, the simple introduction of a new product does not necessarily count as an innovation, as some characteristics first need to be fulfilled by the new product (Quintane *et al.*, 2011).

Product/service innovations, which were studied by 14 of the 45 papers, are the most popular innovation types being researched. Nevertheless, some innovation conceptualisations that do not satisfy the traditional categories were identified by this review, reflecting the need for broader conceptualisations of innovation (Weerawardena, 2003b). The authors' codification procedure aggregates them in three emerging innovation approaches:

- (1) organisational innovation (i.e. when papers broadly define innovation as the combination of all traditional innovation types);
- (2) innovation capability (i.e. when papers consider the means through which organisations innovate); and
- (3) innovation performance (i.e. when papers analyse indicators in terms of the degree of innovation and the performance of the innovation outcomes).

In short, this SLR provides strong evidence that the KMP–innovation relationship exists but is not always through a direct link. This goes in line with Du Plessis (2007, p. 22) who asserted that “knowledge management is not solely focused on innovation, but it creates an environment conducive for innovation to take place”.

6. Limitations and implications for research and practice

This review is limited to journals indexed in the Web of Science™ platform, and the findings are the result of a sample of papers obtained through a research string. However, considering SLR steps, and the proliferation of papers in the fields of KM and innovation, it becomes necessary to consider both a limited time span, and a limited number of knowledge processes, so that the literature review becomes feasible. Furthermore, the authors suggest that future research aiming at review papers from multiple databases should apply quality criteria to the search results. It is also expected that slightly differences will occur during future reproduction of the search steps, as the number of papers retrieved by the databases depend upon institutional subscriptions.

Finally, the extensive review provided by this paper reaches some important practical implications for both researchers and practitioners. The results provided from recent relevant literature show that organisations that want to innovate must set up a bundle of key KMP to achieve innovation outcomes. This paper provides a synthesis of KMP–innovation research that can be valuable as a starting point for future investigation. Further research is needed to deeply understand the intervening role of dynamic capabilities and organisational learning between KMP and innovation. Knowledge sharing through Web platforms calls for further research, as the results are divergent (Saenz *et al.*, 2012; Soto-Acosta *et al.*, 2014). The considerable amount of papers (44 per cent of the empirical papers) that investigate the intervening effects of mediating variables shows that KMP–innovation research is a mature research field. Thus, process (mediation) analysis should complement causal relations, providing answers to “how” questions. Additionally, following previous qualitative research (Connell *et al.*, 2014; Iacono *et al.*, 2012; Pattinson and Preece, 2014; Spaeth *et al.*, 2010; Taminiau *et al.*, 2009), qualitative studies should continue to expand our knowledge about the complex relations between knowledge and innovation in specific organisational realities. Managers should encourage interaction with competitors and customers, required for knowledge acquisition about companies’ products, thus promoting innovation. Human resources managers should also implement commitment-based practices, promoting trust and motivation, increasing knowledge sharing.

Innovation, as a widely researched topic, calls for frequent reviews that can aggregate new conceptualisations. The sample papers analysed by this review show that broad conceptualisations of innovation (Wang and Ahmed, 2004; Weerawardena, 2003b) are currently used, suggesting that KMP play a key role in diverse innovation outcomes. Additionally, innovation studies should also contribute to advance our understanding about the empirical relationships between different innovation types (Ceylan, 2013).

Note

1. TS = (“Knowledge Management” OR “knowledge sharing” OR “knowledge acquisition” OR “knowledge codification” OR “knowledge storage” OR “knowledge application” OR “Knowledge creation”) AND TI = (“innovation”).

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Appendix

Inclusion criteria

- *Papers written in English. Reasoning:* As English is the dominant language of the scientific community, and considering the replicability goal of our SLR, we only included papers written in English.
- *Published in peer-reviewed journals. Reasoning:* As we are concerned with the papers' quality, we assume that by only examining peer-reviewed papers we will ensure higher quality and reliability in our sample.
- *Articles and reviews. Reasoning:* The present review only considers these document types, and excludes, for example, conference proceedings, editorial notes and books.
- *Full paper availability. Reasoning:* Considering the goals of this review, full access to the papers is mandatory. Thus, papers that were not available through the authors' institutional login or due to an embargo policy, were not considered in the final sample.

Exclusion criteria

- *Papers where the level of analysis surpasses the inter-organisational level. Reasoning:* Considering the scientific domain of the authors, only individual, group and organisational levels were considered.
- *Papers that do not explore, directly or indirectly, the KMP–innovation relationship. Reasoning:* Some papers refer to KMP, but do not contribute theoretically or empirically to its relationship with innovation (Laursen *et al.*, 2012; Li *et al.*, 2010).
- *Papers that do not provide enough information about what type of innovation is analysed. Reasoning:* We do not restrict papers by innovation type, although papers that do not clearly define which innovation type is studied were not considered (Iqbal *et al.*, 2011).

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