

Assessing the universality of knowledge management practices

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This is a Final draft version of a publication
published by Emerald Publishing
in Journal of Knowledge Management

DOI: 10.1108/JKM-09-2016-0394

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Please cite the publication as follows:

Hussinki, H., Kianto, A., Vanhala, M., Ritala, P. (2017). Assessing the universality of knowledge management practices. Journal of Knowledge Management, vol. 21, issue 6. pp. 1596-1621.
DOI: 10.1108/JKM-09-2016-0394

**This is a parallel published version of an original publication.
This version can differ from the original published article.**

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Journal of Knowledge Management. Vol. 21 No. 6, 1596-1621.

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Abstract

Purpose

Knowledge is a firm's most valuable resource, and knowledge management (KM), or the ability to leverage knowledge resources, constitutes the base for the firm's competitive advantages. This paper contributes to the emerging discussion on the contextualization of knowledge-oriented research by examining the universality of KM practices.

Design/methodology/approach

A theorized ten-fold conceptualization of KM practices is tested on a sample of 622 firms from four countries (Finland, Spain, China and Russia). Confirmatory factor analysis and principal component analysis are used to test the applicability of the concept in various country contexts.

Findings

The findings provide interesting evidence of variation in the managerial assessment of KM practices among countries. This shows that KM practices are socially embedded phenomena, affected by the managers' institutional and cultural contexts.

Research implications

Researchers and managers are advised to be mindful of the differences in terms of KM practices between the studied countries, and to display a certain cultural sensitivity when approaching KM.

Originality/value

The paper is the first to examine the managerially assessed structure of KM practices in a cross-country context with multi-firm datasets. The results will help to determine the similarity of KM practices in four economically and culturally distinct countries. It also adds to the discussion about the potential national peculiarities of KM and provides a novel concept of KM practices, which is tested in a cross-national context. Thus, this study provides an outline for future KM studies and increases managerial understanding about the variety of value-creating KM practices.

Keywords: knowledge management; knowledge management practices; managerial practices; structure; universality

Article classification: research paper

Introduction

Value creation has shifted from tangible factors, such as financial capital, land, and machinery, to intangible resources of production, such as knowledge (see Penrose, 1959; Barney, 1991; Kogut and Zander, 1992; Grant, 1996; Spender and Grant, 1996; Del Giudice and Maggioni, 2014). The debate surrounding KM has gained momentum during the past two decades, emerging as a significant avenue for management research. KM deals with the practices and processes that enable efficient and effective management of knowledge resources (Alavi and Leidner, 2001; Garrido-Moreno *et al.*, 2014; Chen and Fong, 2015).

Empirical, firm-level KM research has focused on two areas: One has examined how generic knowledge processes (e.g. knowledge sharing, acquisition and creation) are linked with firm performance outcomes (Darroch, 2005; Chen *et al.*, 2010; Lee *et al.*, 2013; Del Giudice and Maggioni, 2014; Garrido-Moreno *et al.*, 2014; Ferraris *et al.*, 2017). The other avenue has investigated the interconnection between KM practices and performance outcomes (Singh, 2008; Chen and Huang, 2009; Hsu *et al.*, 2014; Inkinen *et al.*, 2015; Ardito and Messeni Petruzzelli, 2017). In a fundamental divergence from knowledge processes, KM practices are purposeful organizational and managerial activities aimed at managing the organizational knowledge resources (Foss and Michailova, 2009; Foss and Minbaeva, 2009; Andreeva and Kianto, 2012; Kianto and Andreeva, 2014).

KM practices range from usage patterns of information technology (IT) tools and media to recruitment principles and non-disclosure agreements. They span organizational functions from human resources (HR) to research and development (R&D) and marketing (see Andreeva and Kianto, 2012; Lin and Kuo, 2007; Hurmelinna-Laukkanen, 2011). Understanding the structure of KM practices in firms enables researchers and practitioners to grasp the constitution of organizational activities related to KM. This understanding helps in designing and implementing development and change activities. Ultimately, researchers have argued that the development and implementation of KM practices increases organizational performance, competitiveness and innovativeness (see Chuang *et al.*, 2013; Garrido-Moreno *et al.*, 2014; Inkinen *et al.*, 2015; Kamhawi, 2012). As managers, organization developers and consultants understand, develop and utilize KM practices, they may be more efficient and effective at designing and implementing interventions and at making decisions to improve the leveraging and utilization of knowledge.

While studies have categorized KM practices into several key areas, they have reached no consensus concerning these areas. For example, Heisig (2009) compared 160 KM models and proposed grouping the most-studied KM success factors into human-oriented, organization-oriented, technology-oriented, and management process-oriented categories. In a systematic review of empirical literature on KM practices and firm performance, Inkinen (2016) noted that human resource management (HRM) practices, IT practices, and KM leadership as the KM practices that most often facilitate positive outcomes related to firm performance. However, most studies have dealt with one or two types of KM practice categories only, rather than examining a more comprehensive set (Inkinen, 2016). In summary, the literature has provided various categorizations of KM practices, but without offering evidence of how they correspond to

managers' perceptions of the topic. Therefore, scholarly examination of KM practice profiles remains somewhat vague.

Previous studies have shown that knowledge-sharing activities and management methods can differ in different contexts (Michailova and Husted, 2003; Andreeva and Ikhilchik, 2011; Sergeeva and Andreeva, 2016), regions (Magnier-Watanabe *et al.*, 2011; Domenech *et al.*, 2016), and contingencies (Kim *et al.*, 2014). Therefore, the feasible structure, elements and dimensions of KM practices might differ between firms in different countries. Recently, Inkinen *et al.* (2015) demonstrated that KM practices fall into ten distinct categories in medium and large Finnish companies. However, the literature lacks broad-based evidence of how KM practices are structured in regions and countries.

To bridge this knowledge gap, this paper examines the structure of KM practices in Finland, China, Russia and Spain to examine whether national peculiarities arise in terms of how KM practices are bundled. To achieve this goal, this study involved a structured survey in all four countries followed by factor analysis and comparison of the factor structures.

This study utilizes an amplified categorization of Inkinen *et al.*'s (2015) ten KM practices: supervisory work, knowledge protection, strategic management of knowledge and competence (strategic KM), learning mechanisms, IT practices, the organizing of work, and four dimensions of HRM practices: recruiting, training and development, performance appraisal, and compensation practices. Inkinen *et al.* (2015) based this categorization on a thorough literature review and in-depth understanding of where strategically valuable knowledge resides and how the firm can use it to reach its performance targets.

This paper is thought to be the first to examine the managerially assessed structure of KM practices in a cross-country context with multi-firm datasets. This study will examine whether KM practices are similar in the selected countries, or if structural differences should be highlighted. The results add to the discussion about national peculiarities in KM and provide a novel conceptualization of KM practices and a test of its applicability in a cross-national context. Thus, this study provides an outline for future KM studies and increases managers' understanding of value-creating, knowledge-related practices.

The paper is structured as follows: The theoretical points of departure follow the introduction. The next section presents the research methods and findings. The paper ends with results and conclusions.

Theoretical background

Knowledge management practices

Many people consider knowledge to be the firm's most valuable resource. KM is closely related to organized processes that are aimed at efficient, effective management of the firm's intangible resources, i.e. knowledge (Alavi and Leidner, 2001). The field of KM has attracted growing attention during the past two decades, as academics, business managers, and state-level authorities

have become determined to understand how knowledge issues are associated with value creation and business performance.

Andreeva and Kianto (2012) defined KM practices as a set of management activities aimed at efficient, effective management of organizational knowledge resources. Earlier studies labelled similar activities as critical success factors for KM (Chauvel and Despres, 2002) and enablers of KM (Anand *et al.*, 2015). Studies of KM practices have provided valuable new ways of understanding knowledge-related issues. Business managers may benefit from knowing how the tools and practices can contribute to efficient, effective management of the firm's precious knowledge resources. Previously literature on KM practices has focused on three key categories: HRM practices, IT practices, and supervisory work (Inkinen, 2016). In addition, Heisig (2009) determined that the extant literature on critical KM success factors focuses on four issues: human-oriented factors (i.e. culture, people and leadership), organization-oriented factors (i.e. processes and structures), technology-oriented factors (i.e. infrastructure and applications), and management processes-oriented factors (i.e. strategy, goals and measurement). This paper further develops the theoretical groundings by expanding KM practices into a ten-part categorization (based on Inkinen *et al.*, 2015). This approach is based on theories about utilizing and developing knowledge for the benefit of the organization (Kogut and Zander, 1992; Grant, 1996; Spender and Grant, 1996), incorporating new ideas to update the categorization to represent the knowledge activities in a modern firm. The KM practices are supervisory work, strategic KM, knowledge protection, learning mechanisms, IT practices, organizing work, and four HRM practices dealing with recruitment, training and development, performance appraisal, and compensation practices. This overarching configuration of KM practices was developed to tease out new insights that less comprehensive designs lacked.

Unlike previous models this categorization of KM practices focuses on organizational and managerial practices rather than processes, and it introduces a comprehensive selection of the KM practices a firm can use to improve performance through more effective, efficient management of its knowledge resources. Earlier KM practice models have focused on one or a few practices, such as knowledge-oriented leadership and knowledge-centered HR practices (Donate and Guadamillas, 2011); HRM practices and ICT practices (Andreeva and Kianto, 2012); support from senior management and promotion of the KM program; power decentralization; and IT support (Lee *et al.*, 2012). Thus, they have covered only a small proportion of the wide array of organizational and managerial practices for managing knowledge. Conversely, some studies have attempted to form a more complete conceptual model of KM. These include Anand *et al.*'s (2015) selection of 11 KM enablers, Migdadi's (2009) similar 11-dimensional model, and Joong Kim and Hancer's (2010) five-tier model. The challenging aspect of such models is their complexity, as they have studied practices, processes and resources side by side. This conceptualization of KM practices excludes processes and resources because they make different contributions to performance management:

- Resources, such as intellectual capital or artifacts (see Mariano and Awazu, 2016), represent the static stock or the knowledge base of the firm.

- Knowledge processes are generic activities, such as the acquisition, sharing and creation of knowledge.
- KM practices are purposeful organizational and managerial practices aimed at managing both resources and processes to create organizational benefits.

The next sections explain the ten practices proposed to cover the most important aspects of purposeful KM in contemporary organizations.

Supervisory work

Supervisory work is central to establishing favorable conditions for KM in an organization (DeTienne *et al.*, 2004). Empirical studies have revealed that supervisors who participate, inspire, delegate and support are valuable organizational members, as their involvement is linked with positive firm performance (Sarin and McDermott, 2003; Singh, 2008; Birasnav, 2014). Supervisors pave the way for any KM agenda by creating a trustful, respectful atmosphere and creative culture (Holsapple and Singh, 2001), and by coordinating knowledge integration within a firm (Grant, 1996). Researchers have shown that a well-drafted KM strategy and an expert KM unit can support supervisory work (Lee *et al.*, 2008). The effect on firm performance may be more pronounced if supervisory work is combined with sufficient technological support, KM-specific compensation scheme, and KM-specific training regime (Kamhawi, 2012).

Strategic KM

Strategic KM comprises strategic planning, implementing and updating activities that consider knowledge assets to be the focal point (Kianto *et al.*, 2014). Strategic KM is concerned with the organization's current and future strategic knowledge, building the organization based on a knowledge-based strategy, establishing activities for monitoring and measuring the knowledge assets in the firm, and appreciating their development needs in relation to the business environment (Zack, 1999; Kianto, 2008). Strategic KM practices can contribute to a firm's performance by enabling the firm to focus on the activities that create the most value, as studies have suggested that intangible assets are the focal sources of competitive advantage (Barney, 1991; Grant, 1996; Conner and Prahalad, 1996). Strategic KM also enables the firm to craft strategies based on knowledge-based advantages over competitors (Zack, 1999). Furthermore, strategic KM practices allow practitioners to make more informed decisions about the allocation, utilization, expansion, and sharing of the company's knowledge base that follow the company's overall strategic aims (as suggested by Zack, 1999; see also Von Krogh *et al.*, 2001). Recent empirical literature has discovered that proactive KM strategies involving an explicit concept of KM for management, clearly stated objectives, and recognition of the roles of KM tools, culture, leadership, and HR practices could increase business and innovation performance significantly more than passive strategies (Donate and Canales, 2012). Also, Kamhawi (2012) noted that KM strategy is an influential feature in building an agile organization that can achieve positive business performance outcomes.

Knowledge protection

Knowledge protection is separate from other strategic activities. Knowledge protection mechanisms and practices can be broadly divided into two categories: formal and informal (see Lawson *et al.*, 2012; Hurmelinna-Laukkanen and Ritala, 2012). The formal protection mechanisms

include intellectual property protection, contracts and other formal means to protect knowledge, and they facilitate its firm-specific appropriability (Teece, 1986). In contrast, informal protection mechanisms, such as secrecy and the tacit nature of knowledge, allow firms to keep proprietary core knowledge safe from imitation (Hurmelinna-Laukkanen and Puumalainen, 2007). Some researchers have suggested that the existence of knowledge protection mechanisms might facilitate knowledge sharing and collaboration with the firm's external stakeholders (Olander *et al.*, 2010). However, it is important to distinguish protecting knowledge from hiding it (Rhee and Choi, 2016). The latter is a deliberate attempt to conceal knowledge because of self-interest or political needs and, thus, a negative phenomenon for the exchange of the ideas within the organization.

Learning mechanisms

Learning mechanisms (i.e. improving the quality and increasing the amount of organizational knowledge and competence) are a key facet of an effective, knowledge-based operation. Firms emphasizing learning invest in transferring knowledge from experienced employees to less experienced employees through activities like mentoring, apprenticeships and job rotation (Swap *et al.*, 2001; Bryant, 2005). Systematically collecting and utilizing best practices and lessons learned are other means of supporting learning within the organization (O'Dell and Grayson, 1998; Cross and Baird, 2000).

Employees motivated to learn engage in extra-role behavior and personal development and regard knowledge sharing as an opportunity to expand their competence in interaction with other members of the organization (Rhee and Choi, 2016). Thus, learning mechanisms guarantee that the organization retains and circulates its employees' experiential knowledge. In the organizational context, learning takes place as workplace learning through learning-by-doing or practice-based learning (Gherardi, 2009; Lave, 2009) or through vicarious social learning (i.e. learning from others by observing their behavior and its consequences).

Implementing such practices is likely to improve access to collegial tacit and explicit knowledge, thereby increasing performance quality. Additionally, learning mechanisms (e.g. knowledge sharing among co-workers) can advance creativity by stimulating the flow of knowledge and expanding the stock of knowledge available within the organization (Rhee and Choi, 2016). By building systems and working practices that enable vicarious learning, firms can increase employees' motivation to share and create knowledge. Learning practices also improve a firm's innovation performance by providing opportunities for mentoring and coaching, which will help employees share, build and develop knowledge for the organization's benefit (Inkinen *et al.*, 2015).

IT practices

Technological proficiency has emerged as a basic competence in a modern firm. In today's world, practically all information is online and available through various digital channels; thus, firms adopt new IT practices, as technological solutions can facilitate better leverage over the firm's knowledge resources (Davenport and Prusak, 1998; Alavi and Leidner, 2001) and enable organizational learning (Carayannis, 1999). Recently, the phenomenon of "big data" has become increasingly important to KM, as firms have access to more data from internal and external sources, which they can combine and utilize in their value creation (Sumbal *et al.*, 2017). Overall, the empirical literature has linked the utilization of technological tools to various performance

outcomes for firms (Kim and Hancer, 2010; Steinfield *et al.*, 2010; Cohen and Olsen, 2015; Santoro *et al.*, 2017). For example, Cao *et al.* (2013) argued that the benefit of good IT practices is maximized when they form a good fit with the organization's key business processes. Furthermore, Sumbal *et al.* (2017) suggested that managing big data in thoughtful alignment with organizations' tacit knowledge can provide significant benefits. Organizations also achieve enhanced knowledge exploitation through knowledge storing and combination that are enabled by utilization of KM systems (Santoro *et al.*, 2017) and better innovation performance by applying a variety of critical technological support for collaboration, searching for information, communication, real-time learning, simulation and prediction (Yang *et al.*, 2009). In other words, when IT practices are tailored to support KM activities, the firm has a greater chance of establishing an agile, innovative and well-performing organization (Kamhawi, 2012).

Organizing work

Practices for organizing and dividing up work relate to how the organization should structure power and communication relationships (Mintzberg, 1992). These organizational design issues significantly impact the leveraging of knowledge. From the knowledge-based perspective, the division of work and responsibilities, as well as the coordination of work, should facilitate the leveraging of knowledge within an organization.

As knowledge is largely tacit (Nonaka and Takeuchi, 1995), the best knowledge for decision-making and problem-solving is often dispersed, lying within individuals, groups and communities throughout the organization (Tsoukas, 1996). As a result, decision-making, especially concerning complex issues, should be decentralized to the knowledge-holders at all levels of the organization (Grant, 1996). Previous studies have suggested that the distribution of power and decision-making rights to knowledge workers is likely to speed up organizational activities and promote innovativeness in firms (Davenport and Prusak, 1998), as well as to improve overall organizational performance (Pfeffer, 1998).

As knowledge is shared and developed in social interactions, structures that support fluent interaction and offer possibilities for communication and knowledge sharing seem beneficial. Organizing workers into groups with divergent skills and backgrounds allows for the integration of heterogeneous tacit knowledge, thereby enabling knowledge to flow and complex knowledge products to develop (Grant, 1996). Previous studies have demonstrated that grouping employees into teams with a high degree of autonomy in deciding how to manage the tasks they face yields performance gains (Pfeffer, 1998). Furthermore, establishing and utilizing cross-functional teams may stimulate knowledge creation, whereas too hierarchical a structure slows the flow of knowledge (Nonaka and Takeuchi, 1995). Legitimizing various types of communities of practice and interest is likely to create forums for knowledge development and utilization (Brown and Duguid, 2001; Mohrman *et al.*, 2002). Similarly, reducing organizational barriers by developing egalitarian work practices and boundary-free organizations can support teamwork and shared problem-solving (and, thus, knowledge sharing and transfer across the organization; Youndt and Snell, 2004).

HRM practices

HRM practices are among the most influential KM practices, as they concern the firm's central intellectual capital dimension, which is human capital (Edvinsson and Malone, 1997). HRM practices can be divided into several categories such as heterogeneous work groups and brainstorming (Ardito and Messeni Petruzzelli, 2017), commitment-based HR practices (e.g. employee empowerment and career development; see Soto-Acosta *et al.*, 2014) and knowledge-based recruiting, professional development, and employee retention (Wong and Aspinwall, 2005). In this study, the HRM dimensions concern recruiting, training and development, compensation, and performance appraisal. The selected four practices represent a classic categorization which aims at hiring employees to perform duties, to monitor their performance, and to provide rewards when appropriate (Tichy *et al.*, 1982). HRM practices are performance-enhancing activities for organizations, due to their capability to increase knowledge processes, such as knowledge sharing, acquisition, and creation (e.g. Soto-Acosta *et al.*, 2014; Chen and Huang, 2009) and organizational learning (Lin and Kuo, 2007; Kuo, 2011; Theriou and Chatzoglou, 2009). Moreover, HRM practices are linked with the increase in employees' affective commitment to the organization (Camelo-Ordaz *et al.*, 2011), and they create an atmosphere of impersonal trust (Vanhala and Ritala, 2016), assist in implementing KM strategy (Liao, 2011), and increase the firm's competitiveness and financial performance (Andreeva and Kianto, 2012).

Knowledge management practices: the cross-country context

Previous research has highlighted contextual and regional differences related to knowledge-sharing activities and management methods (Michailova and Husted, 2003; Andreeva and Ikhilchik, 2011; Magnier-Watanabe *et al.*, 2011; Kim *et al.*, 2014; Sergeeva and Andreeva, 2016) as well as HRM practices (Fey *et al.*, 2004). Mental models drawn from the national culture also significantly influence the management of knowledge (Magnier-Watanabe and Senoo, 2010; Magnier-Watanabe *et al.*, 2011; Del Giudice, 2012). Considering this evidence, managerial perceptions of which KM practices are feasible and applicable may vary between different countries. One explanation for this tendency resides in country-specific institutions that regard "more or less taken-for-granted social behavior, which is underpinned by normative systems and cognitive understandings that give meaning to social exchange" (Greenwood *et al.*, 2008).

The institutional context of activity (i.e. structures and mechanisms of social order and cooperation; see Scott, 1995) is the result of formal and informal factors. The formal factors consist of regulatory, political and economic institutions (Holmes *et al.*, 2013), whereas the informal institutions are the socially constructed reality that builds on the systems, shared meanings and collective understandings that formulate cultures (Inglehart and Baker, 2000; North, 1990; Peng *et al.*, 2008; Scott, 1995). Both formal institutions and cultural factors make countries different (Hofstede, 1980).

The distinct formal and informal institutional differences between countries are likely to manifest at the level of KM practices, given their contextual and managerial application. This study presumes that the managerial perception of KM practices is heavily influenced by (1) how formal institutions have steered the activity of companies with regulatory, political and economic decision-making, and (2) how culture in terms of the systems, shared meanings and collective

understandings has taught individuals in different countries to adopt practices that are generally accepted as “the right thing to do”.

Methods

As this study’s conceptualization and structure of KM practices is quite novel, various analyses were performed to test their applicability in the countries studied. The research design focuses on each country sample separately, and the study examined whether the conceptual structure suggested fits the empirical data in each sample. The following sections present the sampling, the data collection and the results.

Sample and data collection

This study utilized data collected from China, Finland, Russia and Spain in 2013–2014 by means of a structured questionnaire, using the “key informant” technique. These four countries represent different cultural and economic backgrounds. For instance, they include both Eastern (China) and Western (Spain, Finland) cultures and that in between (Russia). They also cover developed (Spain, Finland) and emerging (China, Russia) economies, as well as both collectivist (China, Russia) and more individualistic (Finland, Spain) cultural orientations (Hofstede *et al.*, 2010); thus, examination of these four countries provides a good overview of KM in a variety of contexts, enabling the analysis of the universality of KM practices. The initial population from each country comprised a cross-industry sample of companies that included all firms with at least 100 employees. Country-specific databases (e.g. Intellia in Finland and SABI in Spain) were used in identifying the companies. All eligible firms were contacted, and the means of communication varied between countries. For example, in Finland, an external research company contacted each firm by telephone; in other countries, the researchers conducted data collection via telephone or face-to-face interviews. The interviewers emphasized full confidentiality and promised a summary of the results to the respondents.

Altogether, 622 responses were received with the following country sample sizes: Finland (259), Spain (180), China (96), and Russia (87). In all countries, most respondents held positions such as HR director or manager, other director or manager, or managing director, indicating their expertise and key position regarding the issues of KM practices. The companies in the sample represented a wide variety of industries, including manufacturing, the wholesale and retail trades, miscellaneous services, and transportation and storage. The characteristics of samples from different countries are discussed in more detailed in the next section.

Descriptive statistics of the sample

Table 1 illustrates the basic descriptive information of each country sample. In terms of the average age of the firms, there were some differences between the country samples. The average age of Finnish and Spanish companies was around 30 years, while the companies from China and Russia were slightly younger, at approximately 20 years. The oldest companies were from Spain (mean age 31 years) and the youngest from Russia (19 years). In all countries, most of the companies were established 11–50 years ago. It should be noted that the proportion of young companies (established 0–5 years ago) was quite low in the samples from Spain (0.6%) and Russia (4.9%).

Table 1. Descriptive statistics.

	Finland	Spain	China	Russia
N	259	180	96	87
Age (mean; sd)	28.5; 25.09	31; 22.1	23.02; 16.57	18.99; 14.09
Personnel (mean; sd)	445.53; 734.44	336.92; 542.17	6872.7; 36003.67	7037.1; 23192.4
Sales 1000 eur (mean; sd)	156775; 400034	92017.99; 230594	not available	627205; 1556125
Age (%) :				
0-5 years	8.5	0.6	9.3	4.9
6-10 years	11.2	5	9.3	20.7
11-50 years	66.4	83.3	69.8	69.5
50+ years	13.9	11.1	11.6	4.9
Personnel (%) :				
100-249	53.7	65.7	28.2	22.4
250-499	23	22.5	11.8	20
500-999	10.7	8.4	24.7	7.1
1000+	9.4	3.4	35.3	50.6
Industry (%) :				
Largest	Manufacturing (37.8)	Manufacturing (43.9)	Manufacturing (78.1)	Wholesale and retail trade (22.4)
2 nd largest	Services (9.7)	Information and communication (28.3)	Services (5.2)	Manufacturing (20)
3 rd largest	Transportation and storage (8.1)	Other (8.3)	Information and communication (3.1)	Information and communication (15.3)
4 th largest	Administrative and support service activities (7.7)	Professional, scientific and technical activities (7.8)	Transportation and storage (3.1)	Services (14.1)

The size of each firm was assessed by two means: by number of employees and by the volume of annual sales. In the Finnish (53.7%) and Spanish (65.7%) samples, most companies had 100–249 employees, whereas the Chinese (35.3%) and Russian (50.6%) companies had more than 1,000 employees. This was shown also in the mean values for employees, as Russian and Chinese companies had approximately 7,000 employees on average, whereas Spanish and Finnish companies employed 337 and 446 people, respectively. When considering annual sales volume, the variations discovered were quite significant, as Russia had the biggest sales volume average (equivalent to EUR 627 million) while Spain had the smallest (EUR 92 million). Finnish companies were somewhere in the middle, with an average annual sales volume of EUR 157 million. Unfortunately, no information about the sales figures of the Chinese companies was available.

In general, manufacturing was the biggest industry in the three country samples. This varied from China's 78.1% to Finland's 37.8%. In the Chinese sample, over three-quarters (78.1%) of the companies operated in the manufacturing sector, and all other industries were underrepresented (under 5%). Only in the Russian sample did manufacturing trail the wholesale and retail trades by a slight margin. Other industries that were among the four largest in most of the countries were services (Finland, China and Russia) and information and communication (Spain, China and Russia).

Measurement scales

The scales were based on work by Inkinen and his colleagues (reported first time in Inkinen *et al.*, 2015). In total, 43 items measured ten dimensions of the concept of KM practices and were developed as follows. Inkinen *et al.* (2015) developed the supervisory work scale (seven items) based on Boumarafi and Jabnoun (2008). McKeen *et al.* (2005), Kianto *et al.* (2014), and Boumarafi and Jabnoun (2008) influenced the content of the strategic KM scale (five items). The knowledge protection scale (three items) was adapted from Levin *et al.* (1987), Cohen *et al.* (2000), Hurmelinna-Laukkanen and Puumalainen (2007), Hurmelinna-Laukkanen and Ritala (2012), and Lawson *et al.* (2012). Based on Becerra-Fernandez and Sabherwal (2001), Inkinen *et al.* (2015) created the learning mechanisms scale (three items), while articles by Handzic (2011), Negash (2004) and Pirttimäki (2007) formed the basis for the IT practices scale (six items). Inkinen *et al.* (2015) developed the organizing work scale (six items) based on Becerra-Fernandez and Sabherwal (2001), whereas Yang and Lin (2009), and Cabello-Medina *et al.* (2011) offered inspiration for the knowledge-based recruitment scale (three items). Inkinen *et al.* (2015) created the knowledge-based training and development scale (four items) and drew inspiration from Andreeva and Kianto (2012) for the knowledge-based performance appraisal (three items) and the knowledge-based compensation (three items) scales. All measures were based on five-point Likert scales (from 1 = strongly disagree to 5 = strongly agree). The respondents were asked to assess how the different statements on KM practices applied to the organizations they represented.

Results: the structure of the KM practices

This section presents the results of the validity and applicability tests of the proposed model to cover the structure of KM practices in a cross-country context. Further, this section points out the similarities and differences in terms of how the KM practices are structured.

Confirmatory factor analysis (CFA) was performed to test the dimensionality of the structure for the concept of KM practices. The structure for KM practices was expected to exhibit a latent structure of ten factors. Utilizing LISREL 8.50 and PRELIS 2.50 software, the 622 cases were processed by applying the maximum likelihood estimation method. The same analysis procedure was conducted separately for the datasets from each country.

First, to verify that items grouped according to the theorized model, CFA was conducted separately for each factor (KM practice). Some items were removed at this stage as they had large standardized residuals with the other items. This was done iteratively by removing one item at a time.

Next, all ten factors were tested together in all samples. The results showed that the original model needed re-specification to improve fit. Thus, several items were removed according to the values of the standardized residuals. The lowest number of items was removed from the Finnish data (16 items) and the highest from the Russian data (26 items).

Appendix 1 presents the final models and model fit indices for the structure of KM practices in the different countries. The following three absolute-fit measures were obtained: the chi-squared value of the likelihood ratio, the root mean square error of approximation (RMSEA), and the goodness-of-fit index (GFI). Even though all the measures fell within acceptable levels, the non-normed fit index (NNFI), the comparative fit index (CFI) and the incremental fit index (IFI) were needed to ensure the acceptability of the models from other perspectives.

The overall goodness-of-fit measures gave sufficient support to deem the results an acceptable representation of the hypothesized construct (see Appendix 1). Based on cross-validation (see e.g. Hair *et al.*, 2006; Conroy and Motl, 2003), differences emerged in how KM practices are constructed in different countries. In the Finnish sample, all ten hypothesized KM practice categories remained; at the opposite extreme, the Chinese and Russian samples included only eight categories.

In addition, examining item-level differences between countries concerning the validated structure of KM practices produced some observations. In general, in all countries where a specific KM practice existed, the item-level structures were also alike. Regarding the supervisory work category, a set of three items appeared to be applicable throughout the datasets. Furthermore, the structures of knowledge protection, strategic KM, knowledge-based recruitment, knowledge-based performance appraisal, knowledge-based compensation, learning mechanisms, IT practices, and organizing work categories were quite consistent in different countries. Only some single-item differences were observed.

To be fair, the structure of KM practices could be different from what this paper has theorized. For instance, one can argue that the theorized dimensionality of KM practices is non-existent, or that knowledge-based HRM practices (i.e. recruitment, training and development, performance appraisals, and compensation) should be examined as a single factor. Thus, to further establish the dimensionality and validity of the structure for KM practices, three rival models were compared.

- Model 1 – ten correlated factors: Covariance among the items was accounted for by ten factors, each factor representing a distinct component of KM practices and each item being reflective of only a single component. The ten factors were correlated.
- Model 2 – one factor: KM practices were conceptualized as a unidimensional construct, with the covariance among the items being accounted for by a single factor.
- Model 3 – seven correlated factors (all knowledge-based HRM practices under one factor): Covariance among the items was accounted for by seven factors, with each factor representing a distinct component of KM practices and each item being reflective of only a single component. The seven factors were correlated.

Table 2 presents the summary statistics for these three models in all samples. Model 1 was found to outperform Models 2 and 3 in all measures in all samples.

Table 2. Model comparison.

	Model 1 - ten correlated factors	Model 2 - one factor	Model 3 - seven correlated factors
Chi-square (df)	80.84 (76) - 363.83 (279)	746.89 (324) - 1350.33 (324)	495.76 (303) - 786.65 (303)
p-value	0.0 - 0.331	0	0
RMSEA	0 - 0.052	0.111 - 0.135	0.072 - 0.094
GFI	0.892 - 0.908	0.593 - 0.721	0.698 - 0.830
CFI	0.979 - 0.998	0.879 - 0.921	0.936 - 0.959
NNFI	0.971 - 0.997	0.869 - 0.914	0.926 - 0.953
IFI	0.980 - 0.998	0.880 - 0.921	0.936 - 0.959

Note: All samples are included in the table (i.e. the lowest and highest values are presented).

Principal-component factor analysis (PCA) was conducted to gain more in-depth understanding of the construction of KM practices in Spain, China and Russia. The objective was to determine which constructions emerge if the items are not forced to load on some specific factor. First, in the Spanish sample, the items concerning knowledge-based compensation loaded together with knowledge-based performance appraisal practices. Second, in the Chinese sample, the items related to knowledge-based performance appraisals loaded together with knowledge-based training and development. In addition, in the Chinese sample, the items related to strategic KM practices loaded to several other constructs. Finally, in the Russian sample, the items for knowledge-based training and development practices loaded together with other HRM practices as well as with learning mechanisms. Additionally, the items related to IT practices loaded quite randomly. These findings are discussed in more detail in the discussion and conclusions section.

Construct reliability

The reliability of the items was evaluated by their path coefficients and squared multiple correlations (R²). Composite reliability (CR; also known as “construct reliability”) was used to assess the reliability of each factor. A complementary measure was the average variance extracted (AVE), which directly shows the amount of variance that is captured by the construct in relation to the amount of variance due to measurement error.

Appendix 1 shows the reliability statistics. All the items were significantly related to their specified constructs, verifying the posited relationships among the indicators and constructs. The CRs ranged from 0.62 (for organizing work in the Spanish sample) to 0.90 (for learning mechanisms in the Spanish sample), exceeding the minimum recommended threshold of 0.60. The AVE met the recommended 50% (see Diamantopoulos and Siguaw, 2000; Hair *et al.*, 2006) in most constructs in all samples. However, the AVE fell below the threshold limit in a few cases, specifically IT practices and organizing work in the Finnish sample, supervisory work and knowledge-based recruiting in the Russian sample, and organizing work in the Spanish sample. In addition, the R² values were predominantly above or close to the limit of 0.50.

Convergent validity

Evidence of convergent validity can be assessed based on the significance of the factor loadings (Bagozzi and Yi, 1991). As shown in Appendix 1, most of the item loadings were greater than 0.7 (the lowest loading was 0.511), and all loadings were statistically significant at the 0.01

significance level. Stronger evidence can be assessed based on the squared factor loading with a threshold value of 0.5 (i.e. more than 50% of variation in the measures is due to the trait). In this study, most items had a squared factor loading greater than 0.5 (see Appendix 1). Finally, correlation between the constructs can be used to assess the convergent validity (Smith *et al.*, 1996; Bagozzi and Yi, 1991). As seen in Table 3, the correlations between the dimensions of KM practices were all significant, ranging from 0.13 to 0.71. This suggests that all components measured some aspect of the same construct.

Table 3. Correlation matrix.

	Mean	1	2	3	4	5	6	7	8	9
1. Supervisory work	3.34-3.59									
2. Knowledge protection	3.70-4.11	0.169-0.302								
3. Strategic KM	3.39-3.45	0.461-0.603	0.182-0.390							
4. Knowledge-based recruitment	3.80-4.16	0.431-0.585	0.279-0.445	0.357-0.637						
5. Knowledge-based training & development	3.59-3.84	0.451-0.476	0.179-0.347	0.444-0.510	0.366-0.663					
6. Knowledge-based performance appraisals	2.98-3.40	0.494-0.524	0.229-0.299	0.481-0.567	0.322-0.617	0.456-0.478				
7. Knowledge-based compensation	2.73-3.25	0.407-0.508	0.227-0.434	0.438-0.572	0.447-0.647	0.374-0.624	0.517-0.706			
8. Learning mechanisms	3.14-3.68	0.410-0.586	0.193-0.414	0.425-0.635	0.297-0.680	0.348-0.627	0.529-0.693	0.419-0.641		
9. IT practices	3.58-3.97	0.338-0.430	0.182-0.434	0.416-0.449	0.215-0.520	0.324-0.545	0.361-0.408	0.361-0.370	0.364-0.572	
10. Work organizing	2.83-3.60	0.487-0.559	0.133-0.247	0.363-0.534	0.265-0.547	0.320-0.524	0.344-0.491	0.339-0.381	0.291-0.567	0.267-0.395

Note: All samples are included in the table (i.e. the lowest and highest values are presented). All correlations are significant at least at the 0.05 level (2-tailed).

Discriminant validity

The discriminant validity was evaluated with two methods: The first was an assessment of whether the AVE was greater than the variance shared between that construct and the other constructs in the model (i.e. the squared correlation between two constructs; see Fornell and Larcker, 1981). Almost all constructs for all countries fulfilled this condition. In all samples, the model's AVEs were greater than the squared correlation between constructs. The second was an evaluation of the discriminant validity using the method recommended by Anderson and Gerbing (1988); two models were compared for each possible pair of constructs. In the first model, the constructs were allowed to correlate freely, while in the second model, the correlations were fixed as equal to one.

All chi-squared difference tests in all samples were significant, which indicated that all pairs of constructs correlated at less than one. In summary, the results of these two tests provide evidence of a sufficient level of discriminant validity.

Discussion

Assessing the universality of KM practices

Are KM practices universally applicable phenomena, or do managers perceive them differently in different cultural and regional contexts? This study sought to address this issue by empirically examining the structure of KM practices in four countries. To tackle this question, a conceptual framework of ten KM practice categories was proposed and its validity and applicability were examined in different countries by CFA and comparison of the factor structures. In general, the results indicated some similarities, but also several differences between countries in the factor structures, which added weight to the presumptions regarding the role of country-specific institutions in the adoption and perception of KM. The results also support the stream of literature that has suggested the potential of context- and culture-specific differences in KM (Michailova and Husted, 2003; Andreeva and Ikhilchik, 2011; Magnier-Watanabe *et al.*, 2011; Del Giudice, 2012; Kim *et al.*, 2014; Sergeeva and Andreeva, 2016).

The KM practices that were perceived as universally similar (i.e. individual constructs across every country) were supervisory work, knowledge protection, knowledge-based recruiting, learning mechanisms, and organizing work. Previous studies have argued that supervisory work is one of the most crucial organizational tasks, as it creates a creative, trustful, respectful and KM-friendly organizational culture (Holsapple and Singh, 2001). It also plays a central role in coordinating knowledge integration within a firm (Grant, 1996) and can facilitate successful organization-wide KM initiatives (DeTienne *et al.*, 2004). This study affirms that supervisory work shares similar characteristics across nations, despite the difference between factors such as power distance in Finland and power distance in China (Hofstede *et al.*, 2010).

Based on the results, firms in all four countries protect their strategically relevant knowledge by formal means, such as patents and licenses, to secure economic return on investments in R&D and other business-related activities. Conversely, the knowledge protection construct did not include informal means of knowledge protection (e.g. confidentiality, employee guidance) in any of the countries studied. These results deviate from the findings of de Faria and Sofka (2010), who saw in their study of German and Portuguese firms a mix of formal and informal knowledge protection practices in both countries, characterized by strong country-specific aspects. This issue must be studied further to clarify whether the informal practices are seen as inadequate to protect strategically significant knowledge, or simply as something other than knowledge protection.

The only HRM practice that was universally similar between the four countries was knowledge-based recruiting. Firms in any context tend to make recruiting decisions mainly based on the candidates' future potential as well as collaborative and networking abilities. This finding supports the argument from Cameron (2002) that the influence of multinational corporations and Western consultants has set new standards for communication skills internationally. This study refines that

argument by noting that internationally similar demands for communication, collaboration and networking skills are decisive factors in the employability of individuals. Likewise, learning mechanisms demonstrated similar fundamentals in all the countries studied. In this study, learning mechanisms consisted of systematic experience-based learning and learning-by-doing practices (i.e. collection and utilization of best practices), which have been discussed as key learning mechanisms within the literature (Gherardi, 2001; Lave, 2009).

The structure of how work is organized, as perceived by management, was the fifth KM practice category that appeared as an independent construct in all four countries. In every country sample, organizing work was related to empowering employees to participate in decision-making, which previous literature has theorized as a key organizational task (Tsoukas, 1996; Grant, 1996). Additionally, the use of cross-functional teams was an integral part of organizing work in Finland and Spain.

Context-specific peculiarities of KM practices

Despite the similarities discussed above, the results demonstrate that the phenomenon of KM practices is primarily context-specific, as many differences existed between the studied countries. These results generally support earlier findings that regional and cultural factors shape KM (Michailova and Husted, 2003; Andreeva and Ikhilchik, 2011; Magnier-Watanabe *et al.*, 2011; Domenech *et al.*, 2016; Sergeeva and Andreeva, 2016).

The results demonstrated that Finland was the only country where the entire ten-tier KM practice categorization existed. This finding is not a surprise, as the study's conceptual model of KM practices was created by Finnish researchers, whose mindsets are framed by the Finnish business environment. The study also identified notable differences between managers from different countries in terms of how well they differentiated several KM practices as individual constructs.

There were differences in the structure of knowledge-based HRM practices in terms of compensation, performance appraisal, and training and development. Specifically, knowledge-based compensation practices did not emerge as an independent construct in the Spanish sample, knowledge-based performance appraisal was missing in the Chinese sample, and knowledge-based training and development practices were not a separate construct in the Russian sample. As HRM concerns a set of tools and practices to manage the organization's employees (Foot and Hook, 2008), the message of this study is that the contextual factors are especially relevant when management of human capital is examined. These country-specific differences in terms of HRM can be explained to some extent by the large average size of Chinese companies, which leaves companies with comparatively fewer resources to conduct thorough performance appraisals, or by differences in the economic sector breakdown of the sample, which affects the level of KM adoption (i.e. a higher share of knowledge-intensive industries is reflected in a higher adoption-rate of KM). However, more research is required to clarify whether Russian companies conduct comparatively less staff training and development activities, and if compensation practices are organized differently in Spanish companies.

Furthermore, the theorized structure of strategic KM practices did not hold true in Chinese firms. In China, the strategic KM activities loaded together with knowledge protection, organizing work,

IT practices and learning mechanisms. Thus, Chinese firms seem not to possess a formal understanding of KM as a strategic, multifaceted issue, and they have apparently not applied specific KM strategies. Conversely, they seem to have compensated by protecting strategically important knowledge to yield future benefits, collecting and utilizing best practices to develop competences and knowledge, using technology to acquire key benchmark information about their competitors, and organizing their work in a manner that allows the dissemination of strategically important knowledge; thus, a variety of KM practices in Chinese firms compensate for the lack of formal strategic KM activity.

Finally, in Russia, the construct of IT practices did not emerge as a separate factor; rather, it loaded with KM leadership and strategic KM practices. Thus, it seems that Russian firms regard IT practices as more of an issue related to supervisory work or strategic KM practices than as a clearly separate and distinct set of practices.

Implications and conclusions

This study provides interesting findings regarding the universality of KM practices. This section discusses the implications for theory and practice of KM, the study's limitations and some future directions for research.

Implications for theory

This paper demonstrates that the managerially assessed structure of KM practices in Chinese, Finnish, Russian and Spanish firms with over 100 employees was not universal. It confirms that KM practices such as supervisory work, knowledge protection, learning mechanisms, organizing work, and knowledge-based recruiting are widely recognized management activities within firms from very different countries; thus, those practices provide evidence for the universality of KM practices. However, a handful of country-specific peculiarities pointed out cross-sample variance within the theorized structure of KM practices. Therefore, researchers should be aware of the potential context-based dissimilarities within the KM concepts; in other words, they should expect that the theorized structures will not always hold true in their entirety.

The findings of this paper suggest that, while it seems that KM is a relatively universal phenomenon, several contextual and regional idiosyncrasies are at play, as previously suggested (Michailova and Husted, 2003; Andreeva and Ikhilchik, 2011; Domenech *et al.*, 2016; Sergeeva and Andreeva, 2016). Research has suggested that KM issues, such as knowledge sharing, knowledge creation and investment in knowledge development and related activities, are likely to differ in various contexts. This paper extends these findings by presenting empirical evidence of variations in KM practices between countries. Therefore, researchers and managers should be mindful of the contextual and regional differences of KM and express cultural sensitivity when approaching the management of knowledge.

Also, this study revealed that KM is associated with a set of ten practices. Researchers (e.g. Serenko, 2013; Mariano and Awazu, 2016) have asserted that the research field of KM is characterized by a lack of a common theoretical core and an accumulation of knowledge. Adopting the ten-fold categorization suggested in this paper may help to overcome this situation. The ten-

fold categorization is broad enough to encompass the key categories discussed in earlier literature, yet specific enough to tease out managerially meaningful subtleties. The previous empirical papers have typically examined one to two practices to measure the firm's KM activities. These include studies of knowledge-oriented leadership and knowledge-centered HR practices (Donate and Guadamillas, 2011), HRM and ICT practices (Andreeva and Kianto, 2012) and support from senior management and promotion of the KM program, power decentralization and IT support (Lee *et al.*, 2012). The ten-part categorization adopts a more overarching approach to KM practices. Consequently, utilizing a broader categorization permits more fine-grained analysis and more accurate implications for managers, and permits the creation of useful distinctions based on context- and culture-specific peculiarities.

Implications for practice

This amplified definition of KM practices integrated the current understanding of practices aimed at effective and efficient management of the firm's knowledge resources to achieve performance targets. Managers should acknowledge the alternatives that this categorization provides when planning to enhance the management of their firms' knowledge resources.

Chinese firms have not yet fully embraced knowledge-based performance appraisals or strategic KM practices. It is understandable that the large firms that base their income on the scale of production rather than innovation and differentiation have not yet established a highly sophisticated strategy to manage their intellectual resources. However, firms that do not have a differentiation advantage over their rivals are more vulnerable to the forces of competition (Porter, 1980); thus, Chinese managers could design more explicit KM strategies and guide their firms into sustainable competitive advantages through effective, efficient management of knowledge resources. In addition, employee performance reviews should be consistently conducted and aligned with the strategic knowledge focus.

Russian managers should take care of their valuable human capital by proactively providing their employees with training and development opportunities. This implication is linked to the theory of knowledge creation from Nonaka (1991), wherein new knowledge is created when different sources and types of knowledge are combined (e.g. an employee's personal knowledge and knowledge gained from a training module); thus, investments in training and development grow the intellectual potential of the firm. Also, more strategic use of IT for KM purposes could improve the return on IT investments.

Spanish managers would benefit from distinguishing the advantages of knowledge-based compensation practices. As the results suggested, the Spanish firms do not typically reward their employees for sharing, creating or applying knowledge; if they did, the motivational push could benefit the firms in terms of innovation performance (Inkinen *et al.*, 2015).

Limitations and future studies

This paper analyzed the universality of KM practices in four countries that represented different political, economic and cultural regions. To the authors' knowledge, no previous studies have examined this wide a set of KM practice bundled with such an international company-level body

of observations. However, it is likely that studying the model with even more countries would provide different results and stronger evidence of the universality or context-specificity of KM practices. Future studies could continue to test the applicability of the framework of KM practices utilized in this study in other locations.

In addition, other contextual domains beside country could affect how people construct and perceive KM practices. For instance, industries might have their own practices that have developed over time. Firm-specific issues such as size, age and culture are likely to play a role. As this study was focused on country-level examination, these aspects were not investigated in depth. However, further studies could go deeper into these and other contextual issues related to the structure, adoption and applicability of KM practices.

Even though the ten-part categorization of KM practices provides a broader concept for researchers and practitioners to understand crucial organizational and managerial activities, it should not be considered definite or static. The type of knowledge that needs to be managed has changed quite substantially during recent decades due to factors such as digitalization, which led to the adoption of IT practices; thus, the understanding of KM has also gone through a notable change. This categorization of KM practices and the findings attained represent results that are specific not only to regional contexts, but to temporal contexts, as well. Therefore, studies incorporating further contemporary KM practices would be useful.

The selected survey research strategy has its limitations as well. Surveys are incapable of answering *why* and *how* firms in different countries utilize KM practices. Thus, it would be worthwhile to conduct, for example, multiple qualitative case studies to establish supplementary evidence about the identified statistical differences.

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Appendix 1. Measurement items, factor loadings, model fit indices and the key literature sources for the measurement scales.

	To what extent do the following statements on...apply to your company? (1 = completely disagree, 5 = completely agree)	Finland (N=259)	Spain (N=180)	China (N=96)	Russia (N=87)	The key literature sources for the measurement scales
Supervisory work	Supervisors encourage employees to share knowledge at the workplace.	0.803 ^a	-	-	-	Items adapted from Inkinen <i>et al.</i> (2015) Theoretical grounding: Boumarafi and Jabnoun (2008)
	Supervisors encourage employees to question existing knowledge.	0.714***	-	-	0.511 ^a	
	Supervisors allow employees to make mistakes, and they see mistakes as learning opportunities.	0.663***	0.695***	0.563***	-	
	Supervisors value employees' ideas and viewpoints and take them into account.	0.727***	0.813***	0.699***	-	
	Supervisors promote equal discussion in the workplace.	0.704***	0.753***	0.917***	0.829***	
	Supervisors share knowledge in an open and equal manner.	-	-	-	-	
	Supervisors continuously update their own knowledge.	-	-	-	-	
	CR	0.85	0.8	0.78	0.63	
	AVE	0.52	0.57	0.55	0.47	
Strategic KM	Our company strategy is formulated and updated based on company knowledge and competences.	0.644 ^a	0.638 ^a	-	0.841 ^a	Items adapted from Inkinen <i>et al.</i> (2015) Theoretical grounding: McKeen <i>et al.</i> (2005); Boumarafi and Jabnoun (2008)
	Our company strategy addresses the development of knowledge and competences.	-	-	-	-	
	Our company systematically compares its strategic knowledge and competence to that of its competitors	-	-	-	-	
	Our knowledge and competence management strategy is communicated to employees clearly and comprehensively.	0.776***	0.77***	-	0.648***	
	In our company, the responsibility for strategic knowledge management has been clearly assigned to a specific person.	-	-	-	-	
	CR	0.67	0.66	-	0.72	
	AVE	0.51	0.5	-	0.56	

Knowledge protection	Our company's strategic knowledge is protected from those stakeholders to whom it is not intended	0.806 ^a	0.664 ^a	0.551 ^a	0.938 ^a	Items adapted from Inkinen <i>et al.</i> (2015)
	If necessary, our company uses patents, agreements, legislation and other formal means to protect its strategic knowledge.	0.579***	0.834***	0.926***	0.725***	Theoretical grounding: Levin <i>et al.</i> (1987); Cohen <i>et al.</i> (2000); Hurmelinna-Laukkanen and Puumalainen (2007); Hurmelinna-Laukkanen and Ritala (2012); Lawson <i>et al.</i> (2012)
	If necessary, our company uses confidentiality, employee guidance and other informal means to protect its strategic knowledge.	-	-	-	-	
	CR	0.65	0.72	0.72	0.82	
	AVE	0.49	0.57	0.58	0.7	
Learning mechanisms	Our company transfers knowledge from experienced to inexperienced employees through mentoring, apprenticeship and job orientation, for example.	-	-	-	-	Items adapted from Inkinen <i>et al.</i> (2016)
	Our company systematically collects best practices and lessons learned.	0.867 ^a	0.895 ^a	0.933 ^a	0.959 ^a	Theoretical grounding: Becerra-Fernandez and Sabherwal (2001)
	Our company makes systematic use of best practices and lessons learned.	0.911***	0.908***	0.878***	0.93***	
	CR	0.88	0.9	0.9	0.94	
	AVE	0.79	0.81	0.82	0.89	
IT practices	Our company uses information technology to enable efficient information search and discovery	-	-	-	-	
	Our company uses information technology in internal communication throughout the organisation.	0.65 ^a	0.784 ^a	0.888 ^a	-	
	Our company uses information technology to communicate with external stakeholders.	0.62***	0.782***	0.861***	-	Items adapted from Inkinen <i>et al.</i> (2016)
	Our company uses information technology to analyse knowledge in order to make better decisions.	-	-	-	-	Theoretical grounding: Handzic (2011); Negash (2004) and Pirttimäki (2007)
	Our company uses information technology to collect business knowledge related to its competitors, customers and operating environment, for example.	0.661***	0.628***	-	-	
	Our company uses information technology to develop new products and services with external stakeholders.	-	-	-	-	
	CR	0.68	0.78	0.87	-	
AVE	0.41	0.54	0.77	-		

Work organizing	Our employees have an opportunity to participate in decision-making in the company.	0.674 ^a	0.647 ^a	0.822 ^a	0.847 ^a	Items adapted from Inkinen <i>et al.</i> (2016) Theoretical grounding: Becerra-Fernandez and Sabherwal (2001)
	In our company, work duties are defined in a manner that allows for independent decision-making.	0.649***	0.506***	0.842***	0.785***	
	We enable informal interaction between members of our organization.	-	-	-	-	
	Our company organises face-to-face meetings when necessary.	-	-	-	-	
	When necessary, we use working groups with members who possess skills and expertise in a variety of fields.	0.565***	0.624***	-	-	
	When needed, our company makes use of various expert communities.	-	-	-	-	
	CR	0.66	0.62	0.82	0.8	
	AVE	0.4	0.35	0.69	0.67	
Knowledge-based recruiting	When recruiting, we pay special attention to relevant expertise.	-	-	-	-	Items adapted from Inkinen <i>et al.</i> (2015) Theoretical grounding: Yang and Lin (2009) and Cabello-Medina <i>et al.</i> (2011)
	When recruiting, we pay special attention to learning and development ability.	0.672 ^a	0.792 ^a	0.864 ^a	0.65 ^a	
	When recruiting, we evaluate the candidates' ability to collaborate and work in various networks.	0.746***	0.669***	0.862***	0.749***	
	CR	0.67	0.7	0.85	0.66	
	AVE	0.5	0.54	0.75	0.49	
Knowledge-based training & development	We offer our employees opportunities to deepen and expand their expertise.	0.758 ^a	0.813 ^a	0.896 ^a	-	Items adapted from Inkinen <i>et al.</i> (2015)
	We offer training that provides employees with up-to-date knowledge.	-	-	-	-	
	Our employees have an opportunity to develop their competence through training tailored to their specific needs.	0.838***	0.735***	0.818***	-	
	Competence development needs of employees are discussed with them regularly.	-	-	-	-	
	CR	0.78	0.75	0.85	-	
	AVE	0.64	0.6	0.74	-	

Knowledge-based performance appraisal	The sharing of knowledge is one of our criteria for work performance assessment.	0.751 ^a	0.83 ^a	-	0.842 ^a	Items adapted from Inkinen <i>et al.</i> (2015)
	The creation of new knowledge is one of our criteria for work performance assessment.	0.765***	0.764***	-	0.898***	
	The ability to apply knowledge acquired from others is one of our criteria for work performance assessment.	0.737	-	-	-	
	CR	0.81	0.78	-	0.86	
	AVE	0.58	0.64	-	0.76	
Knowledge-based compensation	Our company rewards employees for sharing knowledge.	0.81 ^a	-	0.751 ^a	-	Items adapted from Inkinen <i>et al.</i> (2015)
	Our company rewards employees for creating new knowledge.	0.8***	-	0.889***	0.896 ^a	
	Our company rewards employees for applying knowledge.	0.809***	-	-	0.588***	
	CR	0.85	-	0.81	0.72	
	AVE	0.65	-	0.68	0.57	
	Model fit indices	Chi-square (df)	363.83 (279)	226.60 (153)	81.94 (91)	80.84 (76)
p-value		0.00047	0.00001	0.74078	0.33055	
RMSEA		0.034	0.052	0	0.027	
GFI		0.905	0.892	0.908	0.895	
CFI		0.989	0.979	0.998	0.992	
NNFI		0.986	0.971	0.997	0.987	
IFI		0.989	0.98	0.998	0.992	

Note: ^a Significance level is not available, because the coefficient is fixed at 1. *** Statistically significant at 0.01 significance level.