

**Realizing the value of knowledge resources and capabilities:  
An empirical study**

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## Realizing the value of knowledge resources and capabilities: An empirical study

### Abstract

**Purpose** – Drawing upon the resource-based view of the firm, this paper develops and empirically validates a model, which examines the relationships between technical KM infrastructure (TKMI), social KM infrastructure (SKMI), and competitive advantage provided by KM (CAPKM). The authors argue that KM process capabilities account for the direct effects of TKMI and SKMI on CAPKM.

**Design/methodology/approach** – We employed PLS-SEM to empirically test the hypotheses using a sample of 251 firms from an emerging economy. The results were then confirmed using the bias-corrected bootstrap procedure. We also conducted two robustness checks including: (a) examining a competing moderation model, (b) and performing fuzzy-set qualitative comparative analysis (fsQCA), a set-theoretic method that examines how causal conditions combine into all possible configurations of binary states to explain the desired outcome.

**Findings** – The findings show that TKMI and SKMI have positive effects on CAPKM. In addition, KM process capabilities mediate the direct effects of TKMI and SKMI on CAPKM.

**Originality/value** – This paper complements and advances prior research in several ways. First, the paper develops a conceptual model that depicts the interrelationships between TKMI, SKMI, KM process capabilities, and CAPKM. Second, this paper suggests the critical role of the “action” component (i.e. KM process capabilities) that capitalizes on the KM resources in the creation of CAPKM.

**Keywords** *technical knowledge management, social knowledge management, knowledge management process capabilities, competitive advantage provided by knowledge management.*

**Paper type** Research paper

## 1. Introduction

The knowledge management (KM) literature makes it clear that KM outcomes associated with competitive advantage are based on three separate but highly complementary factors. These factors include technical KM infrastructure (TKMI), social KM infrastructure (SKMI), and KM process capabilities. TKMI refer to technological resources that enable and support KM processes in an organisation. Leonard-Barton (1995) and Grant (1996) propose that the technological dimensions that are part of effective KM include business intelligence, collaboration, distributed learning, knowledge discovery, knowledge mapping, opportunity generation, and security. Recent research on TKMI (Mills and Smith, 2011), however recommend collaboration, distributed learning, and knowledge mapping as the three major dimensions of TKMI. SKMI refer to the role of KM infrastructure elements from social perspectives that stimulate KM activities in an organisation. A broad range of these factors have been identified in the literature such as organisational structure, organisational culture, leadership, people, and KM strategy (e.g. Gold, Maholtra and Segars, 2001; Lee and Choi, 2003; Migdadi 2005; Zheng, Yang, and McLean, 2010). KM process capabilities refer to the ability of firms in “acquiring knowledge, converting it into a useful form, applying or using it, and protecting it” (Gold et al., 2001, p. 190). Various perspectives of KM processes identified in the literature include discover/ generate/ create/ acquire, capture, codify, coordinate/collaborate, accumulate/integrate, transfer, store, share, access, represent, use/ apply, and deploy/exploit (e.g., Mageswari, Sivasubramanian, and Dath, 2017; Pentland, 1995; Wu and Chen, 2014; Zaim, Tatoglu, and Zaim, 2007). However, there is growing consensus in the knowledge management literature that KM process capabilities is a composite construct that captures a firm’s ability in

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3 four facets: knowledge acquisition, conversion, application, and protection (Gold et al., 2001;  
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5 Mills and Smith, 2011; Granados et al., 2017).  
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8 Despite the theoretical and practical importance of KM resources (i.e. TKMI and SKMI)  
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10 and KM process capabilities, the KM literature is limited in terms of two aspects. First, prior  
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12 research has largely focused on narrow conceptions of KM resources and capabilities and  
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14 examined them in isolation focusing on either KM resources or KM capabilities (Gold *et al.*,  
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16 2001; Ashrafi and Mueller, 2015; Andreeva and Kianto, 2012; Byrd and Turner, 2001; Chuang,  
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18 2004; Lee and Choi, 2003). While resources may serve as the basic unit for analysing how firms  
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20 achieve competitive advantage, firms' competitive advantage result from their ability to integrate  
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22 resources that complement one another to create organisational capabilities (Bharadwaj, 2000).  
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24 Indeed, the RBV advocates that "resources are static, . . . and the potential value of resources is  
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26 realized by way of resource deployment competencies, which are how firms capitalize on  
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28 resources to effect superior performance" (Ngo and O'Cass, 2012, p. 863). As such, in the  
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30 current study we propose that KM resources and capabilities may not contribute to firm  
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32 performance in isolation but the performance impact of KM resources and capabilities rests on  
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34 their complementarity.  
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40 Second, the extant literature seems to agree conceptually that KM resources (e.g. TKMI  
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42 and SKMI) should contribute to a firm's competitive advantage. However, empirical results  
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44 provide only mixed support. For example, Powell and Dent-Micallef (1997) and Chuang (2004)  
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46 find that TKMI is not significantly related to competitive advantage, but others find that TKMI  
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48 and SKMI are positively related to competitive advantage (e.g. Andreeva and Kianto, 2012; Byrd  
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50 and Turner, 2001). As such, RBV researchers have raised doubts about the unquestioning focus  
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52 that firms may place on their resources in that "strategic resources only have potential value, and  
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3 that realizing this potential requires alignment with other important organizational elements”  
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5 (Ketchen et al., 2007, p. 962).  
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8 Third, as most extant research on KM infrastructure, processes and capabilities has been  
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10 conducted in Western developed countries such as USA (Gold *et al.*, 2001; Zheng, 2005),  
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12 Australia (Migdadi, 2005), and newly industrialised Asian economies such as Taiwan (Chuang,  
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14 2004), Hong Kong (Khalifa, Lam and Lee, 2001; Khalifa and Liu, 2003), and Korea (Choi and  
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16 Lee, 2002, 2003; Lee and Choi, 2003), the role of these factors in other contexts, such as  
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18 transitional economies (e.g. Vietnam), is still unclear. Transitional economies experience  
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20 unprecedented changes in their economic, social, and legal system as a consequence of their  
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22 transition from central systems to market systems (Child and Tse, 2001). Yet, given the limited  
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24 research in this area, how KM resources and KM process capabilities work together toward  
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26 achieving superior competitive advantage still remains largely unknown (Gimenez and Ricon,  
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28 2003). To examine the interrelationship among KM resources and KM process capabilities and  
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30 their impact on competitive advantage, transitional economies (e.g. Vietnam) offer a unique  
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32 opportunity to test the existing KM theories and to build new ones.  
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38 Our paper is structured as follows. First, by reviewing the extant literature, we establish  
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40 the theoretical relationship between TKMI, SKMI, KM process capabilities, and competitive  
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42 advantage, and present the related hypotheses. We then introduce research methodology,  
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44 analytical procedure, and report findings. Finally, we close by discussing the results, and  
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46 highlighting implications for managerial practice and conclusion.  
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## 2. Theoretical background and model development

The resource-based view is a long-standing theory, which has its foundations in strategic management. The resource-based view asserts that firms attain competitive advantage based on unique resources that remain valuable, rare, inimitable and non-substitutable by other resources (Barney, 1991; Conner, 1991; Schulze, 1992). The fundamental assumption underlying the resource-based view is that resources are heterogeneously dispersed across different firms and the differences between these firms based on the resources remain steady over time (Barney, 1991). Scholarly research on the resource-based view tends to define and classify resources broadly to include assets, knowledge, capabilities, and firm processes (Bharadwaj, 2000). However, Grant (1991) distinguishes between resources and capabilities by classifying resources into tangible, intangible, and human-based resources. While tangible resources refer to financial capital and assets such as equipment, plants, and raw materials, intangible resources include firm reputation, brand image, as well as product quality. Human-based resources include technical know-how and other knowledge assets such as organisational culture and employee training.

While resources remain the basis for which competitive advantage may be achieved, competitive advantage can be created by firms based on their ability to integrate resources that complement one another to create organisational capabilities (Bharadwaj, 2000). Therefore, organisational capabilities involve firms' ability to integrate and utilise valuable resources which complement one another (Amit and Schoemaker, 1993; Russo and Fouts, 1997; Schendel, 1994). From this perspective of resources and capabilities, KM remains central to the identification of what resources are, and how their integration and utilisation as complement create organisational capabilities that can lead to competitive advantage (Hedlund and Nonaka, 1993).

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3 The pivotal role of KM in facilitating competitive advantage from resources and  
4 capabilities include KM infrastructure and KM processes (Gold *et al.*, 2001). While KM  
5 infrastructure can be technical or social (Lee and Choi, 2003), social KM infrastructural  
6 resources may include organisational structure, organisational culture, and people resources  
7 (Chuang, 2004; Lee and Choi, 2003). Gold et al (2001) consider KM infrastructure to include  
8 organisational structure, organisational culture, and technology resources. The conflicting  
9 considerations of the organisational structure, organisational culture, and people and technical  
10 resources obfuscate the understanding of how these resources clearly relate to competitive  
11 advantage. This obfuscation suggests that although a consideration of how social and technical  
12 KM infrastructural resources affect competitive advantage as distinct constructs remains  
13 compelling, the modus operandi through which they contribute to competitive advantage cannot  
14 be discounted.

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31 The extant literature on the role of KM process capability is equivocal and inconclusive.  
32 While some studies consider KM process capability as an independent variable (Gold *et al.*,  
33 2001), others theorize this construct as a mediator (Tanriverdi, 2005), and moderator (Chuang,  
34 2004), which makes it imperative to further clarify the role of KM process capability in the  
35 linkage between KM resources and competitive advantage. In the current study, we position KM  
36 process capability as the mediator in the relationship between KM resources and competitive  
37 advantage. We propose that KM process capability is the salient mechanism in transforming  
38 TKMI and SKMI into competitive advantage. Understanding how TKMI and SKMI are  
39 transformed into competitive advantage through KM process capabilities may shed light on  
40 salience of this mechanism. Our position is in line with an RBV framework in that Ketchen et al  
41 (2007, p. 962) suggest that resources “allow the firm to do a better job of taking strategic actions  
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3 [e.g. capabilities] . . . that capitalize on the resources [to create] a competitive advantage”. We  
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5 build our conceptual model based on this important argument (see Figure 1).  
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### 17 *2.1. Knowledge management and competitive advantage provided by KM (CAPKM)*

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19 Competitive advantage is derived from the assets and resources that constitute a firm (Barney,  
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21 1991; Peteraf, 1993; Dierickx & Cool, 1989). However, while many executives concern  
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23 themselves with acquisition, accumulation and aggregation of assets as a way to create  
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25 competitive advantage, many forget the power that knowledge and information provide in the  
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27 marketplace. In this respect, it has been shown information is a clear source of competitive  
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29 advantage (Porter & Millar, 1985; Altinay, Saunders, & Wang, 2014). Despite that, competitive  
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31 advantage is a complex, multi-dimensional construct that can be construed in many ways  
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33 depending on context. Prior research has examined a construct namely competitive advantage  
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35 provided by information systems (CAPIS) “to measure the contribution of all the IS to  
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37 competitive advantage in an organization” (Byrd & Turner, 2001a, p. 22). In line with this  
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39 stream of research, we examine competitive advantage provided by knowledge management  
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41 (CAPKM). In particular, we draw upon that of Byrd and Turner (2001b), who posit competitive  
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43 advantage includes four dimensions: innovativeness, market position, mass customization and  
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45 inimitability. For knowledge and information to provide competitive advantage, it is within  
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47 reason that a firm’s knowledge management capabilities must also link with these four  
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49 dimensions. Because of this, we look to research by Chuang (2004) as one of the key relevant  
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3 studies in which a four-item measure was developed to assess CAPKM based on the dimensions  
4 outlined by Byrd and Turner (2001b). The findings presented by Chuang (2004) indicate a clear  
5 link between a firm's knowledge management and competitive advantage in the marketplace.  
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## 10 11 12 *2.2. TKMI capabilities and CAPKM*

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14 Building upon the resource-based view, information technology (IT) alone does not generate  
15 sustainable competitive advantage owing to possible imitation by competitors (Ross, Beath and  
16 Goodhue, 1996; Powell and Dent-Micallef, 1997). To be strategically competitive, businesses must  
17 use technologies to leverage or exploit other firm-specific, intangible resources such as  
18 organisational leadership, culture, human resource, and business processes (Clemons and Row,  
19 1991; Henderson and Venkatraman, 1993). Using technology to leverage other resources in the  
20 organisation is deeply rooted in the firm's ability to integrate IT resources that complement one  
21 another to create organisational capabilities that lead to competitive advantage (Grant, 1991). For  
22 instance, prior research finds that the integration of IT practices of KM into organisational  
23 activities and systems has a direct relationship with firm competitive advantage (Andreeva and  
24 Kianto, 2012). Additionally, if such IT practices involve flexible IT infrastructure, it makes the  
25 organisation more responsive and agile, and enhances the firm's capabilities to create  
26 competitive advantage (Byrd and Turner, 2001). The relationship between IT infrastructure and  
27 competitive advantage becomes even stronger when the firm assembles and develops high level  
28 IT personnel knowledge and skill (Byrd, Lewis and Turner, 2005). Accordingly, there is a  
29 reasonable justification to believe that TKMI will have a direct impact on firm competitive  
30 advantage provided by KM. Thus, we hypothesize that:  
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53 *H1: TKMI has a positive effect on CAPKM.*

### 2.3. SKMI capabilities and CAPKM

According to Lee and Choi (2003), organisations with strong social knowledge management resources, including culture, structure, and people, are able to integrate the knowledge management and business planning processes more effectively, to develop reliable and innovation applications that support the business needs of the firm faster than competition, and to predict future business needs of the firm and innovate valuable new product features before competitors. Gold *et al.* (2001) also posit that the social infrastructure of culture, structure and people typically evolve over long periods of time through the sustainability of organisational operations. While each of these resources is difficult to acquire and complex to imitate (Barney, 1991), firms that achieve competitive advantage through KM have also learned to combine their resources effectively to create overall social infrastructure capabilities (Grant, 1991). According to the resource-based view, when firms possess valuable resources which become difficult for other firms to imitate, it offers firms the capabilities to create a sustainable competitive advantage (Barney, 1991; Chuang, 2004). Thus, we hypothesize that:

*H2: SKMI has a positive effect on CAPKM.*

### 2.4. KM process capabilities and CAPKM

Gold *et al.*, (2001) conceptualize KM process capabilities as a composite construct that has four dimensions including knowledge acquisition, conversion, application, and protection. Knowledge acquisition process involves an organization's ability to accumulate relevant knowledge for its operational activities by recognizing and obtaining such knowledge from both internal and external sources. Knowledge conversion, however, refers to the organization's ability to sort, structure, synchronize and allocate knowledge according to common themes to reduce redundancy, increase

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3 consistency, and boost efficiency in terms of usefulness. Knowledge application involves activities  
4 that enable the organization to utilize knowledge effectively in creating value. Knowledge protection  
5 refers to the activities that enable the organization to guard against illegal or inappropriate use of  
6 knowledge. The impact of KM processes on organizational performance outcomes remains well-  
7 established in the literature. In particular, prior research finds a positive relationship between KM  
8 processes, either as a multi-dimensional construct (e.g., Gold *et al.*, 2001; Zaim *et al.*, 2007) or  
9 unidimensional variables (e.g., Mills and Trevor, 2011), and organizational performance. The current  
10 state of the literature is lacking because no detailed explanations are offered as to how and why KM  
11 process capabilities matter in the relationship between KM resources and competitive advantage.  
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24 The contribution of knowledge management processes in gaining and sustaining competitive  
25 advantage has been conceptually discussed in the extant literature. Chakravarthy, McEvily, Doz and  
26 Rau (2005, p.305) posit that while ‘the characteristics of knowledge are primarily valuable for  
27 defending existing advantages, the processes it uses to accumulate and leverage knowledge have  
28 greater implications for creating new sources of advantage’. Each of the three knowledge  
29 management activities plays a distinctive role in providing firms a competitive advantage: knowledge  
30 leverage is necessary for growth, knowledge accumulation to ensure that this growth is profitable,  
31 and knowledge protection to sustain this profitable growth. Based on the dynamic capability based  
32 approach, Nielsen (2006) also demonstrates a connection between knowledge management  
33 processes with the three key dynamic capabilities of development, (re)combination, and use of  
34 knowledge, enabling firms to achieve and sustain a competitive advantage in a dynamic  
35 marketplace (Eisenhardt and Martin, 2000; Hamel and Prahalad, 1996; Powell and Snellman,  
36 2004; Verona and Ravasi, 2003; Winter, 2003).  
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3 For instance, Tanriverdi (2005) found that the infrastructure, strategy making processes,  
4 human resource management processes, and vendor management processes which constitute the  
5 IT relatedness of the firm's business units, enhance KM capabilities across the units of the firm  
6 and, in turn, lead to superior firm performance. Moreover, Zheng, Yang and McLean (2010) find  
7 that KM effectiveness mediate between organisational structure, organisational culture, and  
8 organisational strategy on one side and measures associated with firm's competitive advantage  
9 on the other side. Such findings on KM capabilities bear ample testimony of the potential  
10 mediation role of KM process capabilities between social and TKMI and firm competitive  
11 advantage.  
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24 From the perspective of technology assimilation, IT must be infused and diffused into  
25 business processes to enhance organisational performance (Cooper and Zmud, 1990; Fichman  
26 and Kemerer, 1997; Khalifa and Liu, 2003). In the context of KM, therefore, the technical  
27 infrastructure capabilities should become the enabler of process capabilities to improve its  
28 indirect effect on a firm's competitive advantage (Nguyen and Neck, 2008). The role of how IT  
29 enhances KM processes has been broadly discussed in the KM literature (e.g. Alavi and Leidner,  
30 2001; Alavi and Tiwana, 2005; Davenport and Prusak, 1998; Khalifa and Liu, 2003; Sher and  
31 Lee, 2004; Zack, 1999). Moreover, the ability of such an enhancement of KM processes by IT  
32 infrastructure and the impact of KM process capabilities on competitive advantage has been  
33 established in the literature (e.g., Chuang, 2004; Gold *et al.*, 2001; Tanriverdi, 2005).  
34 Accordingly, we hypothesise that:  
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49 *H3: KM process capabilities mediates the relationship between TKMI and CAPKM.*  
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51 Gold *et al.* (2001) argue that social capital theory stresses the importance of infrastructure  
52 elements, enabling maximisation of social capital by providing a mechanism for social  
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3 interaction of individuals as the basis for KM. Knowledge, or intellectual capital, is created  
4 through the process of exchange and combination that occur within this social network of an  
5 organisation (Nahapiet and Ghoshal, 1998). Closely tied to the theory of social capital, the  
6 knowledge-based theory of the firm also highlights the effective means of coordinating  
7 individuals' activities within the firm and integrating their knowledge (Grant, 1996; Lopez,  
8 2005). This is where the role of organisational infrastructure elements comes into play to  
9 effectively manage the firm's knowledge (Gold *et al.*, 2001).

19 The ability of social knowledge infrastructure capabilities to stimulate and improve KM  
20 process capabilities has been supported by many researchers such as Zander and Kogut (1995),  
21 Szulanski (1996), Hansen (1999), and Appleyard (1996). Additionally, the impact of the  
22 improved KM process capabilities by SKMI capabilities on firm competitive advantage has been  
23 established in the literature by findings in various studies such as Chuang (2004), Gold *et al.*,  
24 (2001), Tanriverdi (2005) and Zheng *et al.* (2010). Accordingly, a reasonable justification exists  
25 for us to believe that KM process capabilities will mediate the relationship between SKMI  
26 capabilities and firm competitive advantage. Therefore, we hypothesise that:

37 *H4: KM process capabilities mediates the relationship between SKMI and CAPKM.*

### 3. Research methodology

#### 3.1. Samples and procedure

46 To test our model, we collected data from firms in Vietnam. The Vietnamese economy has  
47 shown remarkable performance with its steady growth over the last 10 years (Meschi *et al.*,  
48 2017). As an emerging economy, Vietnam offers a rich setting to examine how knowledge  
49 resources and knowledge capabilities are capitalized into competitive advantage. We prepared  
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3 the measurement instrument initially in English and then translated into Vietnamese. We  
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5 checked it for accuracy by using back translation process (Brislin *et al.*, 1973). We used a sample  
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7 of 1000 firms selected randomly from a mailing list of the 2000 Business Directory issued by the  
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9 Vietnamese Chamber of Commerce and Industry. The sampled firms were located in  
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11 HoChiMinh City and Hanoi, the two biggest cities of Vietnam. These firms span diverse  
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13 ownership types (e.g. state-owned, private, international joint venture, foreign wholly owned).  
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15 With the help of a national research firm, we selected a senior manager (e.g. managing director,  
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17 marketing manager, financial manager, R&D manager) in each firm in the sampled list as the  
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19 key informant. A questionnaire packet, included cover letter, stamped return envelope, and  
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21 questionnaire was sent to 1000 senior managers via mail, followed up by two reminders to  
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23 increase the response rate. In the cover letter, we informed the respondents of the academic  
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25 purpose of the research project, the confidentiality of their responses, and promised them a  
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27 summary report in return for their participation.  
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33 We applied pairwise deletion method of missing cases and received 251 useable  
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35 responses, producing an acceptable response rate of 25.1% and satisfying the minimum ratio of  
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37 5:1 between the number of cases and parameters in the study (Hair *et al.*, 2006; Kline, 1998).  
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39 Table I shows the demographic profile of respondents. In total, 68.92 percent of the respondents  
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41 were male and 31.08 percent were female, [which reflects the male dominance in senior](#)  
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43 [management positions of Vietnamese companies](#). Most respondents were in the ages of 31-to-40  
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45 (43.03 percent), followed by 41-to-50 (23.11 percent), less than 30 years of age (21.91 percent),  
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47 and older than the age of 50 (11.95 percent). [This pattern may imply a tendency of encouraging](#)  
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49 [new blood in the management teams of Vietnamese companies](#). Most respondents had tenure  
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51 ranging from 3-5 years (31.08 percent) and 6-10 years (31.08), followed by 11-20 years (21.12  
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percent), 1-2 years (10.36 percent), and longer than 20 years (6.36 percent). All respondents held at least a bachelor degree of which 27.89% were managing directors, 25.10% were from marketing, 15.14% were financial managers, 10.36% were from R&D, 8.37% were from production, 5.98% from HR, 3.97% from project management, and 3.19% from IT. The respondents' company profiles were analyzed on their size, types of ownership, and basic categories of industry. The largest proportion of participating firms were local private-owned (58.17 percent), employing less than 300 employees (81.27 percent) and operated in the service industry (62.15 percent). Only a small percentage was international joint-venture and foreign wholly owned enterprises (8.37 and 7.1. percent, respectively). The result of cross-tabulation analysis shows that a majority of the state-owned companies were of larger size and operated in the manufacturing sector while the service industry consisted of smaller-sized and private-owned companies.

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### 3.2. Measures of constructs

We employed previously developed and well-established scales to measure the focal constructs of the proposed theoretical model. All multi-item constructs were measured with a seven-point Likert scale (1-strongly disagree; 7-strongly agree) as shown in Table II. We measured TKMI as a formative first-order construct with a four-item scale, borrowed from Mills and Smith (2011). We asked managers to respond to the use of technology in operational activities throughout the firms. Following Gold *et al.* (2001), McDermot and O'Dell (2001) and Lee and Choi (2003), we measured SKMI as a formative first-order, reflective second-order construct with a sixteen-item



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3 scale, reflecting three dimensions – structural infrastructure (seven items), cultural infrastructure  
4 (four items), and people infrastructure (five items). On the basis of Gold *et al.* (2001) and Inkpen  
5 (1996), we measured KM process capabilities as a formative first-order, reflective second-order  
6 construct with a twenty-six-item scale, reflecting four dimensions – acquisition process (six  
7 items), conversion process (six items), application process (seven items), and protection process  
8 (seven items).  
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17 Competitive advantage provided by knowledge management (CAPKM) was captured by  
18 a four-item scale based on the work of Byrd and Turner (2001b) and Chuang (2004). Four single  
19 items associated with innovativeness, market position, mass customization, and difficult to  
20 duplicate. Despite its drawbacks (see Hair *et al.*, 2010), the use of single-item indicators in  
21 structural equation models in marketing research is not uncommon (Petrescu, 2013). Prior  
22 research recommends the use of single-item indicators when multiple items cannot be obtained.  
23 Innovativeness is “internally-focused and competitive-advantage seeking, since it encourages  
24 openness to new ideas and cultivates internally-based capabilities to adopt new ideas, processes,  
25 or products successfully” (O’Cass and Ngo, 2007, p. 870). Relative market position is also of  
26 paramount importance for competitive advantage. Firms can erect strong barriers to entry for  
27 their rivals by building and deploying knowledge into favourable market position (Hult *et al.*,  
28 2006). Mass customization is another important dimension of competitive advantage. Indeed,  
29 firms competing in rapidly changing business environments should be able to use and integrate  
30 KM system for recognizing the customers' preference timely and design the products and  
31 services accordingly (Gu, Jitpaipoon, & Yang, 2017; Kotha, 1995). Finally, building KM  
32 systems that are rare, valuable, non-substitutable, and imperfectly imitable is essential for  
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3 competitive advantage. Such KM system make it difficult and expensive for rivals to duplicate  
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5 (Byrd and Turner, 2001b).  
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10 Insert Table II & III about here  
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#### 17 **4. Analysis and results**

##### 18 *4.1. Common method bias*

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21 In the current study, we used cross-sectional data to test the proposed theoretical model using a  
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23 single-informant approach. As such, common method bias effects may lead to spurious  
24  
25 relationships among the variables (Podsakoff, MacKenzie, Lee and Podsakoff, 2003). Therefore,  
26  
27 we applied the following statistical remedies to test for common method bias. We conducted the  
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29 marker variable technique (Lindell and Whitney, 2001), using gender as a marker variable. The  
30  
31 average absolute correlation between gender and all other constructs in our model was .05 (*rm*).  
32  
33 The average difference between the correlations among all constructs in the model after  
34  
35 partialing out the effect of *rm* was 0.02, and the intercorrelations between all the constructs in  
36  
37 our model remained significant after partialing out the effect of *rm*. This suggests that “the  
38  
39 results cannot be accounted for by common method variance” (Lindell and Whitney, 2001, p.  
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41 118). We also examined the correlations between TKMI, SKMI, KM process capabilities, and  
42  
43 competitive advantage, and calculated their corresponding Variance Inflation Factor (VIF)  
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45 values to ensure no multicollinearity problem. We found no evidence of multicollinearity  
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47 because the VIF scores ranged between 1.20 and 3.08, which were far below the critical value of  
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49 5 (Hair, Sarstedt, Hopkins and Kuppelwieser, 2014).  
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#### 4.2. Hypothesis testing

We conducted the hypothesis testing through a three-stage process. First, we employed partial least squares analysis (PLS) with SmartPLS 3.0 software (Ringle, Wende and Becker, 2015) to test the proposed hypotheses. PLS-SEM is a non-parametric approach, which “draws on composites formed from the indicators and applies a series of ordinary least squares regressions to estimate partial model structures with the objective of minimizing the error terms . . . of the endogenous constructs” (Hair et al., 2017, p. 4). Second, we supplemented this analysis with the PROCESS macro, a bootstrapping technique recommended by Preacher and Hayes (2008). PROCESS is a computational tool available for SPSS and SAS that simplifies the implementation of mediation, moderation, and conditional process analysis with observed variables (Hayes, 2013; Hayes et al., 2017). PROCESS has become especially popular in business and management as evidenced by its appearance in prior research (e.g. Cameron and Stone, 2010; Van Den Hooff et al., 2012). Third, we checked the robustness of the main findings by conducting fuzzy-set qualitative comparative analysis (fsQCA). fsQCA is a novel methodology, which is based on the idea that causal relations are frequently better understood in terms of set-theoretic relations rather than correlations (Ragin, 2008; Fiss, 2011).

##### 4.2.1. PLS-SEM

As shown in Table IV, TKMI positively influences competitive advantage (Model 1,  $\beta=0.14$ ,  $t=2.15$ ), thus hypothesis 1 is supported. In the same vein, SKMI positively influences competitive advantage (Model 1,  $\beta=0.62$ ,  $t=13.12$ ), thus hypothesis 2 is supported. In hypothesis 3, we predicted KM process capabilities mediates the relationship between TKMI and competitive advantage. As shown in Model 2, TKMI positively influences KM process

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3 capabilities (Model 2,  $\beta = 0.26$ , t-value = 4.63), which in turn positively influences competitive  
4 advantage (Model 2,  $\beta = 0.64$ , t-value = 7.60). We compared Model 1 and Model 2 and found  
5 that the positive effect of TKMI on competitive advantage in Model 1 became insignificant in  
6 Model 2 ( $\beta = 0.04$ , t-value = 0.80). By calculating the variance accounted for (VAF), we sought  
7 to determine the size of the indirect effect in relation to the total effect, which was 0.81. That is,  
8 81% of the total effect of TKMI on competitive advantage was indirect, so KM process  
9 capabilities fully mediates the effect of TKMI on competitive advantage, in support of  
10 Hypothesis 3.  
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15 In hypothesis 4, we predicted KM process capabilities mediates the relationship between  
16 SKMI and competitive advantage. As shown in Model 2, SKMI positively influences KM  
17 process capabilities (Model 2,  $\beta = 0.68$ , t-value = 13.8), which in turn positively influences  
18 competitive advantage (Model 2,  $\beta = 0.64$ , t-value = 7.60). We compared Model 1 and Model 2  
19 and found that the positive effect of TKMI on competitive advantage in Model 1 became weaker  
20 in Model 2 ( $\beta = 0.19$ , t-value = 2.54). By calculating the variance accounted for (VAF), we  
21 sought to determine the size of the indirect effect in relation to the total effect, which was 0.70.  
22 That is, 70% of the total effect of SKMI on competitive advantage was indirect, so KM process  
23 capabilities partially mediates the effect of SKMI on competitive advantage, in support of  
24 Hypothesis 4. We also controlled for firm size and ownership type which had no significant  
25 relationships with competitive advantage.  
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29 For our robustness check, we examined a competing model with KM process capabilities  
30 as a moderator between TKMI and competitive advantage, and between SKMI and competitive  
31 advantage, rather than as a mediator. However, the moderating effects were insignificant  
32 ( $p=0.01$ ,  $p=0.02$  respectively). This provides greater evidence for the mediation model as  
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opposed to the moderating model. In addition, we also found that the interaction between SKMI and TKMI had no significant effect on competitive advantage.

#### 4.2.2. *PROCESS* macro

In order to provide further support for the mediating effect of KM process capabilities, we followed Preacher and Hayes' (2008) mediation analysis procedure. In particular, we used the PROCESS macro Model 4 (Hayes, 2013), which provides bootstrap estimates with bias corrected confidence intervals of the indirect effects. The mediation effects were significant (hypothesis 3: TKMI → KM process capabilities → competitive advantage,  $b=0.30$ ,  $CI= 0.22 - 0.41$ ; and hypothesis 4: SKMI → KM process capabilities → competitive advantage,  $b=0.56$ ,  $CI= 0.40 - 0.77$ ).

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Insert Table IV in here  
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#### 4.2.3. *Fuzzy-set qualitative comparative analysis*

We reanalyzed the hypotheses using fuzzy-set qualitative comparative analysis (fsQCA) in order to enhance the robustness of our finding. fsQCA is complementary to structural equation modeling that examines pre-determined relationships (Woodsie, 2013). In this study, we employed a three-stage approach recommended by Fiss (2011) and Ragin (2008) to conduct fsQCA. First, we transformed the measures of constructs in the model into fuzzy-set membership scores. Specifically, we calibrated all the independent and dependent variables of our study, which involves classifying values of each variable into full membership (covering 95% of the

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3 data values), cross-over (covering 50% of the data values) and full non-membership (covering  
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5 5% of the data values). Second, we constructed and refined the truth table that presents all  
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7 possible configurations of causal conditions of the desired outcome by selecting a frequency  
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9 threshold and a consistency threshold. Frequency refers to the minimum number of cases  
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11 required for a configuration to be considered (Fiss, 2011). We set the frequency threshold at 30  
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13 to ensure that the configurations selected captured at least 80% of cases. Consistency refers to  
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15 the degree to which the cases sharing a given configuration of attributes exhibit the desired  
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17 outcome (Fiss, 2011). We set the consistency threshold at 0.87 which is above the minimum  
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19 consistency threshold of 0.80 (Ragin, 2008). Third, we used the Quine-McClusky algorithm to  
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21 logically reduce the truth table rows to simplified configurations. The fsQCA results in Table V  
22  
23 show that TKMI, SKMI, and KM process capabilities are all significantly associated with  
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25 competitive advantage (raw coverage = 0.67; consistency = 0.87). This indicates that none of the  
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27 conditions is sufficient to increase competitive advantage; yet the combination of TKMI, SKMI,  
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29 and KM process capabilities is required to achieve competitive advantage. Thus, we provide  
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31 greater robustness to our findings by illustrating that TKMI, SKMI, and KM process capabilities  
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33 are important elements of a complex causal combination in explaining variance in competitive  
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35 advantage.  
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Insert Table V in here  
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## 5. Discussion

This paper set out to examine the role of technical (TKMI) and social (SKMI) knowledge management infrastructure within a firm and their effect on competitive advantage. Specifically, the primary objective was to determine whether TKMI and SKMI are determinants of a firm's knowledge management process capabilities (KMPC) and whether KMPC mediates the relationship between TKMI, SKMI, and competitive advantage. The results support current research and confirm that both TKMI and SKMI have direct effects on competitive advantage. In addition, the findings extend existing theory and show that KMPC acts as a mechanism between both TKMI and SKMI and a firm's competitive advantage.

The acquisition, management and application of knowledge within a firm can have a powerful influence on an organisation's competitive advantage. To conduct such activities, firms must employ an assortment of technical infrastructure and social capital in order to achieve strategic outcomes. However, for these technical and social assets to fully achieve their desired aim, a range of supporting processes must be in place to bring them to life.

In this instance, the technological KM infrastructure provides the network capabilities that allow organisational members to locate and make use of knowledge resources. At the same time, the SKMI provides the organisational culture where employees and managers understand theirs and each other's roles in knowledge management. Together, the technological and social infrastructures create a suite of process capabilities that formalise knowledge management within the organisation. Ultimately, it is these KMPCs that determine a firm's competitive advantage.

Such a system eventually challenges typical resource-based views of competitive advantage (e.g. Barney, 1991; Conner, 1991) where organisational resources are considered to positively influence competitive advantage because they are unique, not substitutable and

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3 relatively finite within a given market. However, many CIOs are likely to attest that technical  
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5 infrastructure is readily substitutable and can easily be copied by other firms. That is not to say  
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7 the value of technical infrastructure is in any way diminished. In fact, the current research  
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9 provides compelling evidence that technical resources provide the foundation for competitive  
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11 advantage, which is consistent with theory put forward by Amit and Schoemaker (1993) and  
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13 Russo and Fouts (1997).  
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17 Along with this, the current study demonstrates and confirms the theory of Bharadwaj  
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19 (2000) that integration of resources is critical for developing organisational capabilities. There is  
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21 a large body of research (e.g. Andreeva and Kianto, 2012; Byrd and Turner, 2001; Chuang,  
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23 2004; Granados et al., 2017; Grant, 1991) in which resources are defined in a number of ways,  
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25 including technical, social, cultural, or tangible/intangible. However, there is a distinct lack of  
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27 cohesion in how these resources are combined to create competitive advantage. In real-world,  
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29 live scenarios this can be highly problematic for two closely related reasons. First, TKMI  
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31 investment not only has the potential to demand large capital outlays but typically requires long  
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33 lead times from planning to deployment. Second, even the best TKMI has the potential to be  
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35 under-utilised or lie dormant if the requisite social and cultural infrastructure is not deployed to  
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37 make use of the technology. As such, if organisations, project teams and managers do not  
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39 adequately plan the integration of technical and social resources, any investment in TKMI is  
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41 likely to be costly and have limited influence on sustainable competitive advantage (Gold *et al.*,  
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43 2001). Despite that, simply possessing TKMI and SKMI resources is not the proverbial silver  
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45 bullet that will ensure ongoing competitive advantage. Instead, it is the way these resources  
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47 combine to form a range of process capabilities that will ultimately deliver lasting competitive  
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49 advantage.  
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3 The knowledge management processes in place within an organisation are critical  
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5 determinants in both developing and sustaining new sources of competitive advantage  
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7 (Chakravarthy *et al.*, 2005). However, previous research has typically focused on the effects of  
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9 TKMI and SKMI on competitive advantage in isolation. Rather, the current study has looked at  
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11 how TKMI and SKMI simultaneously influence competitive advantage. As such, it appears to be  
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13 the first evidence that KMPC is the mechanism that influences the relationship between TKMI  
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15 and SKMI as independent variables and competitive advantage as the primary dependent  
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17 variable. From a theoretical perspective, the findings provide empirical support for the  
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19 propositions forwarded by Nguyen and Neck (2008) that TKMI (and, by association SKMI)  
20  
21 should be the 'enabler' of process capabilities, which then provide an indirect route to  
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23 competitive advantage. From a managerial perspective, such evidence provides a mandate for  
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25 internal policy development covering each step in the knowledge management process.  
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31 Building on this, the current research has demonstrated that managers need to put in place  
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33 programs that will allow the organisation to develop its knowledge management process  
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35 capabilities. More specifically, programs that link with the four dimensions of knowledge  
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37 management outlined by Gold *et al.* (2001) - acquisition, conversion, application and protection  
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39 – must be managerial priorities to build process capabilities. This is because a firm's knowledge  
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41 management process capabilities allow the technical and social knowledge management  
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43 infrastructure to come to life. Ultimately, this is how ongoing competitive advantage is  
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45 developed and maintained.  
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49 To acquire knowledge, firms need to engage in two key activities. The first is  
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51 benchmarking of their own knowledge management practices against industry and global  
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53 standards. The second is to develop a culture of collaboration, where employees are willing to  
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3 collaborate and share knowledge internally, as well as externally within a firm's network of  
4 partners (Gold et al., 2001). This collaboration then allows the aggregation and accumulation of  
5 knowledge that can be harvested for strategic and operational purposes.  
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10 Being able to harvest knowledge contained within an organisation is dependent on  
11 established conversion mechanisms. In this respect, managers must look to formalise a set of  
12 rules or directives, whereby individuals can easily tap into existing knowledge or have access to  
13 other employees in procedures that mandate group decision-making.  
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19 For effective use and application of knowledge, guidelines and policies must then be  
20 developed that situate organisational knowledge not as a static asset, but as a constantly  
21 evolving, dynamic open-source entity. While the application of knowledge has some clear  
22 overlap with conversion, organisational culture is sure to have a major impact on how readily  
23 members share – or search for – information. Because of this, there is likely to be an ongoing  
24 tension between the need for immediate, short-term gains obtained through formal procedures to  
25 share information and longer-term gains that emanate from a culture of knowledge sharing. As a  
26 result, managers must look to develop an organisational culture where knowledge sharing  
27 becomes accepted, automatic and habitual (He & Wei, 2009). This way, managers can ensure  
28 formal knowledge management processes are complemented by informal, socially-led  
29 knowledge sharing (Granados et al., 2017)  
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44 The final piece in the puzzle that is a firm's process capabilities is knowledge protection.  
45 The protection of knowledge is a complex, difficult task for any organisation. No doubt, firms  
46 can use patents or copyright to protect knowledge assets. However, this is an area for future  
47 research, where protection of knowledge needs to be examined away from the typical  
48 frameworks that position legal or technical IT provisions as the only available powers.  
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3 Apart from these managerial necessities, the current research has redefined the  
4 antecedents of competitive advantage as independent and mediator variables, thereby  
5 challenging what has been found in previous research. Namely, that knowledge management is  
6 presented as a single construct when considering its influence on organizational performance  
7 outcomes (e.g., Zack, McKeen, and Singh, 2009). By contrast, the current study demonstrates  
8 that although performance implications of KM depend on KM practices, such KM practices  
9 include TKMI and SKMI forming the basis of KM activities, where KMPC operates as a key  
10 facilitator of organizational performance outcomes. Additionally, the findings on the antecedents  
11 of competitive advantage offer significant theoretical implications for existing models that  
12 consider single dimensions of multi-dimensional constructs as either independent or mediator  
13 variables for organizational performance outcomes (e.g., Mageswari *et al.*, 2017; Tseng, 2016;  
14 Tseng, 2010). What is more, the findings of this study provide evidence that knowledge  
15 conversion and organizational culture operate both independently (as mediator and independent  
16 variable respectively) and jointly (where each variable forms part of a multi-dimensional  
17 construct) as determinants of organizational performance. Specifically, where organizational  
18 culture contributes to SKMI and knowledge conversion contributes to KMPC.

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40 The findings from the current study provide evidence for KMPC as a mediator between  
41 KM infrastructure and competitive advantage. When viewed against previous research where  
42 organizational performance outcomes are seen as directly dependent on KM infrastructure and  
43 KMPC (e.g., Mills and Smith, 2011; Zaim *et al.*, 2007), the current study appears to extend  
44 existing theory. For example, although Mills and Smith (2011) found no significant direct effect  
45 of technology infrastructure and organizational culture on organizational performance, future  
46 research may look at the role of KMPC as a mediator in the model. Additionally, the mediation  
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3 role of KMPC implies that although organizational performance directly depends on both KM  
4 infrastructure and KM processes as found by Zaim *et al.*, (2007), there is also a significant  
5 indirect relationship between KM infrastructure and organizational performance through the  
6 mediation of KMPC.  
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12 Current theory from existing KM research (e.g. Wu & Chen, 2014) suggests KMPC has  
13 no direct relationship with organizational performance outcomes unless the relationship is  
14 mediated by business process capability. However, the present study challenges assertions by  
15 Wu and Chen (2014), by demonstrating a significant, direct link between KMPC and competitive  
16 advantage. Thus, although business process capabilities may intervene in the relationship  
17 between KMPC and organizational performance, such an intervention does not invalidate a  
18 direct relationship between KMPC and organizational performance. Future research may be  
19 required to further test this relationship.  
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31 In addition to the theoretical and managerial contributions outlined, the current study has  
32 answered the call by Gimenez and Ricon (2003) for additional research investigating the role of  
33 KM in less-developed countries. For this study, Vietnam was used as the referent country, given  
34 it has been identified as a developing nation (United Nations, 2016). Previous research has  
35 examined individual countries in order to develop and test generalizable theory (Nguyen *et al.*,  
36 2003; Vu *et al.*, 2016; Zhou, 2017), so the use of a single country as the context for the current  
37 study is in keeping with extant literature. That said, this means there is still substantial scope for  
38 future research to ensure the findings hold in other developing nations, particularly those that lie  
39 outside Asia.  
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51 Less developed countries, such as Vietnam, are likely to have less TKMI resources than  
52 more developed nations. Likewise, there is the potential for less-developed nations to have lower  
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3 levels of SKMI resources as the existing human capital within the labour force is also still in a  
4 developmental phase. By extension, it is plausible this would also lead to less formal KM  
5 processes given KM may still be in its infancy. Regardless, the findings from the current study  
6 indicate existing theory developed in more advanced nations is applicable in less-developed  
7 countries and vice-versa. This is an exciting development, both theoretically and managerially. It  
8 indicates the absolute values of each variable are not as relevant as the relationships between  
9 them. As a result, irrespective of the actual expenditure on TKMI and SKMI, if managers can put  
10 in place processes to harness the power within the organisation's KM resources, on-going  
11 sustainable competitive advantage is a viable, obtainable outcome.  
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24         Apart from the organisational or economic advantages that may be derived from  
25 knowledge management, there may also be a range of positive social implications. Based on the  
26 premise that 'knowledge is power', it may be that knowledge management and process  
27 capabilities can be used at the regional, national or transnational levels to effect change that will  
28 have positive social, environmental and economic outcomes (Laszlo & Laszlo, 2002). For  
29 example, knowledge management and information sharing have been shown to significantly  
30 influence the management of poverty and disability (Buetten et al., 2012). Likewise, the ability  
31 for stakeholders to share knowledge and engage in an informed discourse was a key driver in  
32 Iceland's response to the global financial crisis of the 2000s (Duffy et al., 2017). If such macro-  
33 level knowledge management practices continue to evolve, it is possible we will see the  
34 continual development of 'knowledge cities' (Ergazakis et al., 2004). This would be particularly  
35 beneficial for developing nations, such as Vietnam, where the development of knowledge and  
36 KM abilities could result in increased investment from international firms.  
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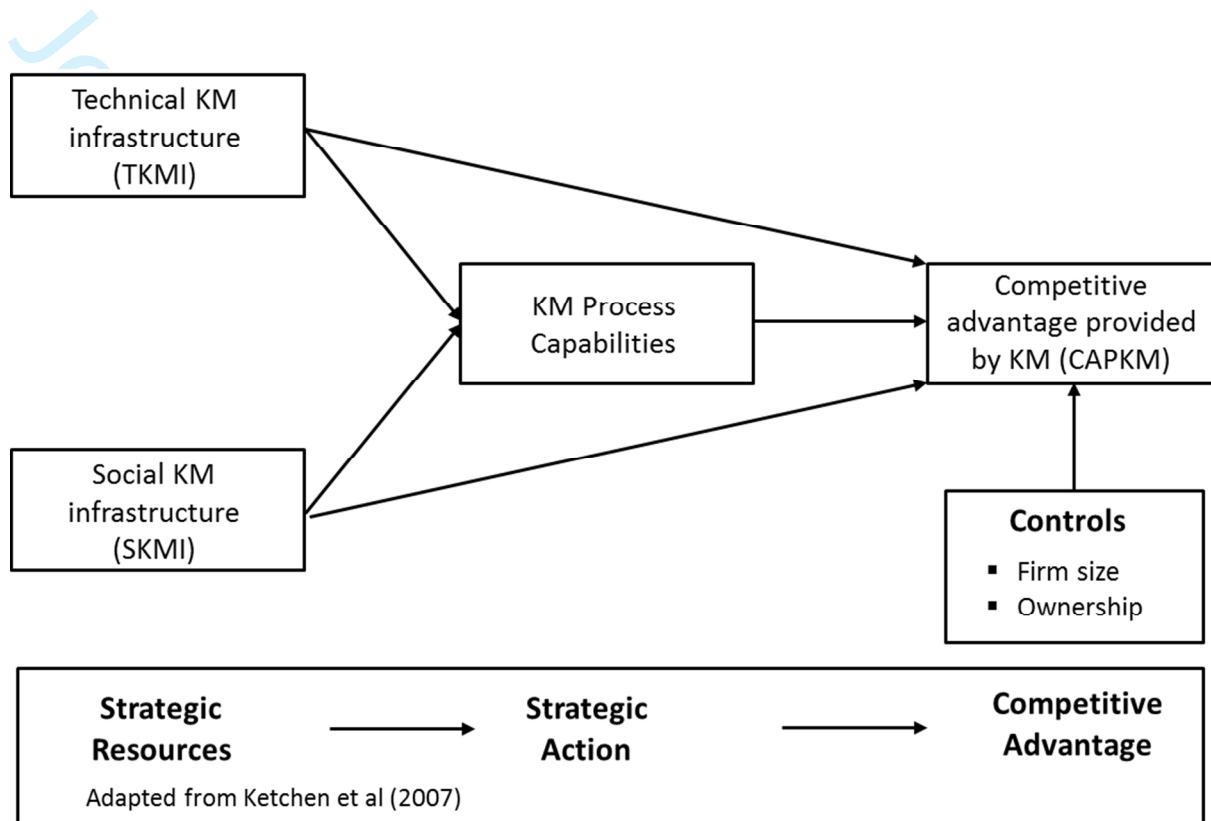
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Despite the significant theoretical and managerial implications of the present study, it has several limitations which also offer avenues for future research. First, because the present study utilizes a cross-sectional survey, the relationships between variables are associative rather than predictive. Thus, future research may adopt a longitudinal approach to examine the present model. Second, KMPC as a mediator in the present study's model offers a novel and important contribution to scholarly research in KM. However, the data for testing the model emanated from a developing country (i.e., Vietnam). Therefore, future research will be required to test the model in more advanced countries in order to compare the extent of consistency or variation in the model across contexts. Third, the present study's model examines the outcome of KM infrastructure and KMPC on organizational performance with respect to competitive advantage. However, other outcomes of KM infrastructure and KMPC on organizational performance can be financial performance, employee engagement/attrition, innovation among others (e.g., Tseng, 2010, 2016; Mageswari *et al.*, 2017; Zack *et al.*, 2009). Future research may examine the impact of SKMI, TKMI, and KMPC on KM outcomes other than competitive advantage. Finally, the current research sought to identify the relationships between the different knowledge management dimensions. However, how these dimensions interact in different strategic contexts is clearly an area for future research. While people and organisational culture are key ingredients for successful knowledge management initiatives (Rubenstein-Montano *et al.*, 2001), an organization's strategic context will influence selection of the most appropriate initiatives that link with overall corporate objectives (Zack, 1999). What is more, the current research involved firms from a range of industries. In future, it may also be beneficial to examine the differences and commonalities in knowledge management processes that exist between firms that have similar strategic contexts but operate in different industries.

## 6. Conclusion

In the modern business environment, knowledge is a highly valuable commodity that can offer significant competitive advantage. This paper has examined the relationships between Technical KM infrastructure, Social KM infrastructure, KM process capabilities and competitive advantage. Moving away from the typical resource-based view of competitive advantage provides an objective picture of knowledge and its movement through the KM network from acquisition, through to conversion. In turn, viewing the route knowledge takes to influence competitive advantage sheds light, not just on the mechanisms at work within the network, but on the managerial responsibilities for ensuring KM processes are in place and clearly linked to the requisite organisational outcomes. The findings from the current research indicate senior management cannot assume expenditure on technical KM infrastructure alone will result in increased competitive advantage. Instead, Chief Knowledge Officers must ensure KM infrastructure is matched with KM process capabilities that will facilitate the acquisition, conversion, application and protection of knowledge.

Figure 1. Theoretical framework



**Table I** Demographics of the respondents

Demographics	Frequency (n = 251)	%	Demographics	Frequency (n = 251)	%
<i>Gender</i>			<i>Tenure</i>		
Male	173	68.92	1 – 2 years	26	10.36
Female	78	31.08	3 – 5 years	78	31.08
<i>Age</i>			6 - 10 years	78	31.08
<30	55	21.91	11 - 20 years	53	21.12
31 – 40	108	43.03	> 20 years	16	6.36
41 – 50	58	23.11	<i>Ownership</i>		
>50	30	11.95	State-owned	62	24.70
<i>Job title</i>			Private	146	58.17
Managing director	70	27.89	International joint venture	21	8.37
Financial Manager	38	15.14	Foreign wholly owned	18	7.17
Marketing Manager	63	25.10	Other	4	1.59
Production Manager	21	8.37	<i>Firm size (number of employees)</i>		
R&D Manager	26	10.36	<50	45	17.93
IT Manager	8	3.19	50 - 199	112	44.62
HR Manager	15	5.98	200 - 299	47	18.73
Project Manager	10	3.97	300 - 499	17	6.77
<i>Education</i>			>500	30	11.95
Bachelor's degree	180	71.71	<i>Sector</i>		
Master's degree	58	23.10	Manufacturing	95	37.85
Doctor's degree	13	5.179	Service	156	62.15



**Table II** Scale items and latent variable evaluation

Construct and items	Weight
<b>Technical KM Infrastructure (TKMI)</b>	
My organization uses	
1. technology that allows employees to collaborate with other persons outside the organisation	0.13
2. technology that allows people in multiple locations to learn as a group from a single source or at a single point in time	0.29
3. technology that allows people in multiple locations to learn as a group from a multiple source or at multiple points in time	0.09
4. technology that allows it to map the location (e.g. an individual, specific system, or database) of specific types of knowledge	0.86
<b>Social KM Infrastructure (SKMI)</b>	
<i>Structural Infrastructure (SI)</i>	
My organization ('s)	
1. structure facilitates the discovery of new knowledge	0.21
2. structure facilitates the creation of new knowledge	0.06
3. bases our performance on knowledge creation	0.09
4. has a standardised reward system for sharing knowledge	0.09
5. designs processes to facilitate knowledge exchange across functional boundaries	0.01
6. managers frequently examine knowledge for errors/mistakes	0.60
7. structure facilitates the transfer of new knowledge across structural boundaries	0.23
<i>Culture Infrastructure (CI)</i>	
In my organisation, ...	
1. employees understand the importance of knowledge to corporate success	0.41
2. high levels of participation are expected in capturing and transferring knowledge	0.24
3. on-the-job training and learning are valued	0.29
4. senior management clearly supports the role of knowledge in our firm's success	0.34
<i>People Infrastructure (PI)</i>	
My organisation's members ...	
1. can understand not only their own tasks but also others' tasks	0.14
2. can make suggestions about others' tasks	0.14
3. can communicate well not only with their department members but also with other department members	0.38
4. are specialists in their own field of expertise	0.59
5. can perform their own task effectively without regard to environmental changes	0.06
<b>KM Process Capabilities (KMPC)</b>	
<i>Acquisition Process (AP)</i>	
My organisation ...	
1. has processes for acquiring knowledge about our customers	0.38
2. has processes for generating new knowledge from existing knowledge	0.30
3. has processes for acquiring knowledge about our suppliers	0.11
4. has processes for distributing knowledge throughout the organisation	0.37
5. has processes for acquiring knowledge about new products/services within our industry	0.08
6. has processes for exchanging knowledge between individuals	0.44
<i>Application Process (APP)</i>	
My organisation ...	
1. has processes for using knowledge in development of new products/services	0.31
2. has processes for using knowledge to solve new problems	0.10
3. matches sources of knowledge to problems and challenges	0.17
4. uses knowledge to improve efficiency	0.03
5. uses knowledge to adjust strategic direction	0.21
6. is able to locate and apply knowledge to changing competitive conditions	0.13
7. takes advantage of new knowledge	0.41

**Table II** Scale items and latent variable evaluation (continued)

Construct and items	Weight
<i>Conversion Process (CP)</i>	
My organisation ...	
1. has processes for filtering knowledge	0.33
2. has processes for transferring organisational knowledge to individuals	0.25
3. has processes for absorbing knowledge from individuals into the organisation	0.25
4. has processes for integrating different sources and types of knowledge	0.03
5. has processes for organising (store/file) knowledge	0.03
6. has processes for replacing outdated knowledge	0.43
<i>Protection Process (PP)</i>	
My organisation ...	
1. has processes to protect knowledge from inappropriate use inside the organisation	0.38
2. has processes to protect knowledge from inappropriate use outside the organisation	0.05
3. has processes to protect knowledge from theft from within the organisation	0.16
4. has processes to protect knowledge from theft from outside the organisation	0.05
5. has extensive policies and procedures for protecting trade secrets	0.02
6. values and protects knowledge embedded in individuals	0.19
7. clearly communicates (create awareness of) the importance of protecting knowledge	0.47
<b>Competitive Advantage provided by KM (CAPKM)</b>	
1. My organisation often uses knowledge-based innovation	0.61
2. My organisation's market position can strong barriers to entry for other firms	0.03
3. My organisation uses knowledge management to widen the array (line/range) of products without increasing costs	0.31
4. The knowledge management capability in my organisation would be difficult and expensive for rivals to duplicate	0.33

KM – knowledge management; TKMI and CAPKM are formative first-order constructs; SKMI and KMPC are formative first-order, reflective second-order constructs (Type III model)

**Table III** Construct means, standard deviations, and correlations

Research constructs	Mean	SD	1	2	3
1. Technical KM Infrastructure (TKMI)	4.84	1.01			
2. Social KM Infrastructure (SKMI)	5.37	0.75	0.49		
3. KM Process Capabilities (KMPC)	5.49	0.77	0.43	0.72	
4. Competitive Advantage provided by KM (CAPKM)	5.26	1.00	0.30	0.60	0.71

**Notes:** Correlation is significant at the 0.01 level (2-tailed *t*-test).

**Table IV** Hypothesis testing

Dependent variable	Independent variable	Model 1			Model 2		
		$\beta$	<i>t</i> -value	$R^2$	$\beta$	<i>t</i> -value	$R^2$
CAPKM	Technical KM Infrastructure	0.14	2.15	0.49	0.04	0.80	0.62
	Social KM Infrastructure	0.62	13.12	-	0.19	2.54	-
	KM Process Capabilities	-	-	-	0.64	7.60	-
	<i>Control</i>						
	Firm size	0.03	0.65	-	0.03	0.74	-
	Ownership	0.08	1.82	-	0.06	1.31	-
KM Process Capabilities	Technical KM Infrastructure	-	-	-	0.26	4.63	0.67
	Social KM Infrastructure	-	-	-	0.68	13.81	-

Note: CAPKM = competitive advantage provided by KM; KM= knowledge management

**Table V.** fsQCA configurations results

Complex solution			
Model: CAPKM = f (TKMI, SKMI, KMPC)			
Algorithm: Quine-McCluskey			
Frequency cutoff: 30.000000			
Consistency cutoff: 0.865672			
	Raw coverage	Unique coverage	Consistency
TKMI*SKMI*KMPC	0.673561	0.673561	0.865672
Solution coverage: 0.673561			
Solution consistency: 0.865672			
Note: CAPKM=competitive advantage provided by KM; TKMI= technical KM infrastructure; SKMI=social KM infrastructure; KMPC=KM process capabilities			

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