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Do Critical Success Factors of Knowledge Management Mediate Knowledge Sharing Driven Performance in the Software Sector of Pakistan?

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Abstract

This research intends to investigate the role of knowledge sharing (KS) practices in the overall performance of the software sector using the critical success factors of knowledge management (KM) process and infrastructure capabilities as intermediate measures. In this regard, survey method was employed and the study utilized the adapted instrument to draw inference from the data collected from software developers. Parallel Multiple Mediation model proposed and tested using Process Macro was applied. The findings of this study revealed that KS practices have a significant and positive effect on overall performance in terms of operational excellence, financial achievement, customer intimacy and product leadership. The results indicated that all the constructs of the KM process and infrastructure capabilities partially mediate the relationship between KS practices and the performance of the software sector. Hence, the findings of this study support all the suggested hypotheses and draw the inference that KM process and infrastructure capabilities support the theoretical prisms of KBV initiatives.

Keywords: knowledge infrastructure capabilities, knowledge process capabilities, knowledge sharing, performance

Introduction

In this era of globalization, external environment is competitive and challenging for all types of businesses. Therefore, this era is attributed as the 'knowledge driven' era where numerous trends have emerged as 'drivers' for leveraging the value of

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organizations, such as self-regulation of markets, their digitalization and globalization.

In knowledge economies, enterprises benefit from contemporary knowledge to strengthen their sustainable performance and competitive positioning (Chen et al., 2012). Therefore, in addition to the physical resources of an organization (plant, building, labor), if the managers are asked which is the most valuable resource to leverage sustainable performance, the answer undoubtedly would be 'knowledge'.

Knowledge is viewed as one of the most crucial and intangible resources – even more decisive than other physical resources of an organization such as capital, land, and labor (Barney, 1991; Nonaka et al., 2000). In view of 'knowledge' being the driving force in any knowledge driven economy, managers need to pay more attention towards KM initiatives as firms broadly concentrate on how knowledge sharing (KS) practices can stimulate their performance.

In general, organizations have started to consider the importance of KS practices as a key source of value creation, competitiveness and strategy formulation for decision making (Tiwana, 2001; Keskin, 2005). KS practices are crucial to augment both the individual and organizational performance in terms of value creation, competitiveness, and improving the decision-making capabilities of employees (Bhojaraju, 2005; Zárraga & Bonache, 2003; Davenport & Prusak, 1998).

Knowledge-based view (KBV) is an offshoot of the resource-based view (RBV) of an organization (Barney, 1991). Consistent with prior streams of studies, this research is based on the knowledge and resource-based view of organization. It argues that knowledge resources are rare, non-imitable and valuable which provide competitive edge and superior performance outcomes (Grant, 1996; Karkoulian et al., 2013; Barney, 1991; Decarolis & Deeds, 1999). Therefore, in this dynamic market place, the success of an organization predominantly depends upon the effective deployment and utilization of knowledge resources (Perez & Pablos, 2003). Thus, KS practices amid entities, groups and individuals are essential drivers for knowledge creation, application and protection, enabling resource structuring and processing capabilities to leverage higher performance outcomes (Lee & Sukoco, 2007; Wang et al., 2012).

KS practices leverage substantial benefits for both firms and individuals. In short, these are viewed as the transmission and synchronization of organizational knowledge comprising a set of shared meanings and understanding of job-related knowledge (Liu et al., 2005; Haas & Hansen, 2007; Lin, 2007; Gold et al., 2001).

Drawing from above, it can be asserted that knowledge is used as the primary input to drive the knowledge-oriented sectors including the software sector in a knowledge economy (Wu & Chen, 2014; Zack et al., 2009; Gold et al., 2001). Therefore, in order to make the internal-external performance of the software sector more sustainable, recurrent and competitive, this study seeks to investigate the key issue in this regard, that is, the mediating role of KM capabilities for KS driven performance of the software sector.

In this dynamic market place, the globalization of the factors of production exerts an immense pressure on managers to strive for the critical success factors of KM in order to get optimal performance outcomes (Lee & Sukoco, 2007; Marques & Simon, 2006). These critical success factors are commonly known as KM capabilities which comprise KM processes and infrastructure capabilities (Mills & Smith, 2011; Zack et al., 2009). Hence, knowledge acquisition, implementation, protection and thereafter, its deployment and dissemination are some of the crucial aspects which should be addressed and draw the attention of the reader in the emerging high-tech (software) sector of Pakistan.

KM critical success factors comprise KM process and infrastructure capabilities. KM process capabilities involve knowledge acquisition, application, protection and transfer, whereas KM infrastructure refers to the culture, structure and technological capabilities of an organization (Lee & Choi, 2003; Mills & Smith, 2011; Gold et al., 2001; Alavi & Leidner, 2001). Moreover, KM capabilities are a compound phenomenon which generally refers to the firms' process capabilities used to assist KS practices through a series of managerial and non-managerial processes (Tanriverdi, 2005; Lee & Choi, 2003). Both the knowledge processes and infrastructure capabilities are valuable knowledge resources for firms to achieve sustainable competitive advantage which, in turn, yields superior performance outcomes (Wang et al., 2014; Zack et al., 2009; Zaim et al., 2007; Lee & Sukoco, 2007; Gold et al., 2001; Grant, 1996).

KM capabilities are predominantly regarded as knowledge proficiencies that tend to encourage KS practices through the sequence of managerial procedures and activities (Tanriverdi, 2005; Lee & Choi, 2003). KS practices support the managers to implement KM strategies in order to align the organizational process, structure and culture aimed to promote the transfer of knowledge that may enhance performance outcomes (Huang & Wu, 2010; Wang & Wang, 2012).

Many studies illustrated the role of KM process and infrastructure capabilities on firms' performance (Zaim et al., 2007; Zack et al., 2009; Huang & Wu, 2010; Wang & Wang, 2012; Wang et al., 2014). According to the best of the authors'

knowledge, no study was found that specifically investigated the mediating role of the critical success factors of KM in the context of the software sector of Pakistan, although few studies did focus on the role of KS practices and their detrimental effect on the performance of an organization (Lee & Choi, 2003; Marques & Simon, 2006; Mills & Smith, 2011; Gold et al., 2001; Wang & Wang, 2012). However, there is still a lack of literature in the South Asian context investigating the mediating role of the critical success factors of KM in the high-tech (software) sector of Pakistan.

In this era of the 4th industrial revolution, the rise of the 'digital economy' accounts for USD 11.5 trillion worth of digital assets, representing 15.5 percent of the global GDP. The worth of digital assets is continuously growing all over the globe due to the rise of digital economy, which is an essential part of knowledge economy. Pakistan is among the most populated countries in the world (population: 220 million) with enormous human and knowledge capital, where 60 percent population falls in the age group of 15-29 years. Currently, more than 2000 IT companies are operating in Pakistan. It has 13 software technology parks and more than 20,000 IT graduates and professionals are produced each year by Pakistan's higher education institutes (HEIs).

Information technology is a critical factor that drives the knowledge economy and it is an essential contributor in economic growth. During the last two decades, digital growth has increased significantly in Pakistan. This sector is contributing around 1 percent (USD 3.5 billion) of GDP and further accounts for 70 percent (USD 1.06 billion) growth in exports during the last 10 years. It represents 60 percent of exports in computer software, 25 percent in computer consultancy software and 13 percent in other allied computer services. Out of 2000 software houses, about 1500 software houses cater the needs of the indigenous market and corporate sector. Growth in this sector is envisioned to be around USD 20 billion in 2025, if proper knowledge process and infrastructure capabilities are to be leveraged to this sector. Therefore, rapid digital inclusion in terms of the increasing number of IT zones and software technology parks has to investigate the intervening role of KM capabilities for KS driven performance amid IT professionals and engineers.

Literature Review and Hypotheses Development

Knowledge Sharing and Performance

In knowledge economies, investment initiatives in knowledge resources are imperative to survive in a global and dynamic environment, where KS practices

improve the innovative capability and performance (Kumar et al., 2013). As asserted by Bartol and Srivastava (2002), KS is the transmission of ideas, technical know-how, contextual information, expertise and proficiencies amid employees through formal and informal interaction within and across groups of organizations. Employees' social interactions and structures are the most convenient ways to share work related knowledge among them. KS practices amid employees are essential to determine the firm's ability to innovate and compete (Jasimuddin et al., 2012; Szulanski, 2000). KS practices tend to augment the learning capacity of employees and assist in knowledge process capabilities that, in turn, improve organizational effectiveness (Dyer & Nobeoka, 2000).

Prior literature posits two sets of knowledge commonly distinguished as 'explicit and tacit', 'solicit and voluntary' and 'constructible and un-constructible' knowledge (Nonaka & Takeuchi, 1995; Teng & Song, 2011). Both explicit and tacit forms of knowledge and their sharing provides constructive foundations to the firms that helps them to acquire a competitive position (Felin & Hesterly, 2007; Reus et al., 2009). Explicit knowledge is formal, constructible and systematic knowledge embedded in manuals, documents, procedures and organizational databases. This type of knowledge is easy to measure and is codified in numerical values.

Beijerse (1999) asserted that explicit knowledge is structured information comprising standardized practices and can be easily transmitted amid organizational actors. Unlike explicit knowledge tacit knowledge is unstructured and informal, it is embedded into the minds of the people and is difficult to exploit and externalize (Piccoli, 1966; Rehman et al., 2015). It is also known as people-oriented knowledge. Knowledge endorsed in the form of official documents (manuals, dossiers, reports, interoffice notifications) and training programs tends to enhance the firms' ability to innovative, as well as its productivity and operational performance (Wang & Wang, 2012; Van den Hooff & De Ridder 2004). Lawson et al. (2009) asserted that firms integrate and share explicit knowledge through formal procedures to improve their business process capability. Carr and Kaynak (2007) contended that knowledge shared through formal procedures tends to assist in solving the crucial issues of organizations about product quality innovation and service improvement, which are important strands of performance outcomes.

Tacit knowledge is interpersonal, contextual and reflects intellectual capabilities that enable the organizational actors to share their experiences and intuitions in order to solve complex problems (Matthew & Sternberg, 2009). This

type of knowledge is difficult to express in written form and applies to business process models due to its context specificity (Holste & Fields 2010). However, social interaction is an equally important way to share tacit knowledge which resides in the minds of the people. Holste and Fields (2010) advocated that people learn this knowledge from the external and internal environment. Prior research affirmed that tacit knowledge is a source of value creation and better financial performance via reducing cost, better product delivery and lesser product quality problems (Du et al. 2007; Sher & Lee, 2004; Law & Ngai, 2008).

Furthermore, KS practices provide a set of benefits to organizations in terms of innovation, creativity, competitiveness, effectiveness and superior performance outcomes (Jonsson & Kalling, 2007; Davenport & Prusak, 1998). Thus, Law and Ngai (2008) concluded that KS practices are paramount for promoting the worth of valuable knowledge resources. They provided a constructive and innovative lens for solving complex problems of business organizations by adapting new approaches and techniques which tend to enhance their productivity and performance.

Lee (2001) alluded that both explicit and tacit forms of KS positively boost the operational and financial performance in terms of customer satisfaction, market orientation and product leadership, service quality, operational excellence and financial achievements.

H_1: There exists a positive relationship between KS practices and firm performance.

Knowledge Sharing, KM Process Capabilities and Performance

Organizations need to demonstrate the best KM practices to improve capacity building by ensuring investment initiatives in intangible resources that create value for them. Gold et al. (2001) posited that KM capabilities encompass KM process and infrastructure capabilities. Prior research viewed that knowledge acquisition, protection and application are fundamental strands of KM capabilities that significantly influence the organizational performance in positive terms (Lin & Kuo, 2007; Lee & Sucoko, 2007; Seleim & Khalil, 2007; Lee & Lee, 2007; Mills & Smith, 2011; Lee & Choi, 2003; Pearlson et al., 2019). KBV suggests that effective KM initiatives strengthen the KM process capabilities led performance within the organization (Jennex et al., 2008). These capabilities concentrate on the acquisition, integration and diffusion of knowledge that assists the organization to gain competitive advantage through exploiting knowledge assets properly (Yao, 2007).

Knowledge Acquisition, Knowledge Sharing and Performance

Nonaka (1994) posited that knowledge acquisition is the development of innovative knowledge through replacing the contents of its existing tacit and explicit forms. Knowledge acquisition is also referred to as knowledge identification, creation and accumulation that determine a firm's capacity to innovative. Knowledge acquired from internal and external resources improves a firm's dynamics and business process capability (Nonaka & Tackeuch's 1995; Turner & Makhija, 2006; Mills & Smith, 2011; Lee & Choi, 2003). Turner and Makhija (2006) advocated that knowledge workers perform an essential role in the knowledge creation process by utilizing internal resources such as experiential learning, research projects and observations. They also utilize available external sources such as market forces, customers, competitors and regulatory bodies. This process enables organizational stakeholders to exploit their knowledge for productive purposes such as competitive innovation process, improving the problem-solving capability and firm performance (Zahra & George, 2002).

According to Grover and Davenport (2001), the next step after acquiring fresh knowledge is to converge it into structured and accessible information, so that it can be preserved in repositories for sharing. Zahra and George (2002) argued that knowledge acquisition primarily depends upon a firm's absorption capacity which ascertains its ability to productively use the acquired knowledge. Thus, a firm's absorption capability positively influences its performance (Lyles & Salk 1996; Seleim & Khalil, 2007).

H_2: KS practices positively influence knowledge acquisition.
H_3: Knowledge acquisition positively influences firm performance.
H_4: Knowledge acquisition mediates the relationship between KS practices and firm performance.

Knowledge Application, Knowledge Sharing and Performance

Knowledge application stipulates the substantial use of valuable knowledge to products and services. The process entails the transmission of knowledge from the point of its creation to its application, thus making it more effective for leveraging value for the organization (Bhatt, 2001). Droge et al. (2008) alluded that optimal knowledge application at lower cost yields competitive advantage that can improve the productivity and performance of firms.

Similarly, prior research stressed that knowledge application leverages value for firms through product development and innovation, enhances their operational efficiency and productivity, aligns corrective actions to solve dynamic problems

and structures business process capabilities and strategic alliances (Park, 2006; Gold et al., 2001; Droge et al., 2008; Probst et al., 2000; Mills & Smith, 2011; Sarin & McDermott, 2003). Thus, knowledge application indicates the replacement of outdated knowledge with relevant and innovative knowledge in organizational processes aimed at making knowledge more effective in organizational performance (Bhatt, 2001). Therefore, the solicitation of knowledge application and firm performance is only possible if knowledge is integrated from both formal (rules, regulations, standards) and informal procedures (interpersonal, intuitive, contextual and intellectual capabilities) and thereafter, it's sharing for sustainable performance of firms (Grant, 1996).

H_5: KS practices positively influence knowledge application.
H_6: Knowledge application positively influences firm performance.
H_7: Knowledge application mediates the relationship between KS practices and firm performance.

Knowledge Protection, Knowledge Sharing and Performance

Protection of valuable knowledge from illegal and inappropriate use is mandatory for its constructive functioning within an organization (Mills & Smith, 2011). Thus, residing knowledge in the organization's repository through electronic data bases, documentation and expert systems are a source of competitive positioning and value creation (Tan et al., 1998). Alavi and Leidner (2001) suggested that organizations need to establish the effective mechanism for knowledge storage and protection. Organizations protect and store the knowledge for future use (Probst et al., 1998). Thus, the knowledge residing in repositories such as electronic data bases, documentation and expert systems is a source of competitive positioning and value creation. Gold et al. (2001) argued that protection of knowledge refers to prevention of knowledge from theft and illegal use. Lee and Yang (2001) asserted that knowledge protection through intellectual property rights (IPRs) and technology can be achieved by granting access only to authorized users. Access to knowledge can be protected duly through user name and password. Thus, prior studies indicate that sustaining and maintaining of IPRs and ICTs are sources of competitive positioning that lead to better performance outcomes (Hoetker & Agarwal, 2007; Droge et al., 2008; Gold et al., 2001).

H_8: KS practices positively influence knowledge protection.
H_9: Knowledge protection positively influences the performance of firms.
H_{10}: Knowledge protection mediates the relationship between KS practices and a firm's performance.

Knowledge Sharing, KM Infrastructure and Performance

Organizational culture, structure and technology are important strands of KM infrastructure capabilities (Zack et al., 2009; Lee & Sucoko, 2007; Gold et al., 2001). Islam et al. (2015) illustrated that culture, structure and technology are deliberated as the key determinants that stimulate KS practices within the organization.

Organizational Culture, Knowledge Sharing and Performance

Organizational traits such as its norms, values, beliefs and myths shape the organizational culture (Forehand & Gilmer, 1964; Robbin, 2004). Some authors demonstrated that the success of an organization relies on various organizational traits because a positive set of values, beliefs, norms and behaviors nourish an effective organizational culture (Schein, 1990; Kotter & Heskett; 1992).

A knowledge promoting culture corroborates the transfer of knowledge among a firm's employees (Kazi, 2005). Numerous researchers (Ajmal & Koskinen, 2008; Wiewiora et al., 2013) perceived that culture incorporates the organizational framework for social interaction and constitutes norms with regards to what is "right" and "wrong".

Essential elements of organizational culture are trust, collaboration, learning and development which positively influence knowledge sharing and organizational performance (Janz & Prasarnphanich, 2003). Nesan (2012) illustrated that KS behavior is influenced by the norms and behaviors within an organization. Other researchers (Abzari & Teimouri, 2008; Chin-Loy & Mujtaba, 2007) identified that culture is an important aspect that fosters KS practices through collaboration and communication.

Prior literature psoited that organizational culture increases the sustainable performance of firms (Denison, 1990; Kotter & Heskett, 1992; Mills & Smith, 2011). Another research by Mills and Smith (2011) recognized the notion that culture enhances the profit of an organization. Aydin and Ceylan (2009) also suggested that knowledge-oriented culture boosts organizational performance.

H_{11}: KS practices positively influence the organizational culture.
H_{12}: Organizational culture positively influences firm performance.
H_{13}: Organizational culture mediates the relationship between KS practices and firm performance.

Decentralization, Knowledge Sharing and Performance

Organizational structure is defined as the formal administrative mechanism designed to allocate the work activities and responsibilities of the employees (Ghani

et al., 2002). Effective organizational influence can impact an organization's longevity and its tendency to share knowledge that eventually improves its productivity and effectiveness (Kim & Lee, 2006; Sharratt & Usoro, 2003; Abouzeedan & Hedner, 2012; Jarvenpaa & Staples, 2001).

Organizational structure encompasses two dimensions: centralization and decentralization (Willem & Buelens, 2009). Centralization alludes to the flat, hierarchical level and the non-participatory structure where the upper and middle level management has more authority to make decisions (Damanpour, 1991). Centralization is a formal structure where knowledge is shared through formal mechanisms such as rules, regulations, and policy documents (Schminke, et al., 2000). Prior research asserted that transformation in organizational structure from the hierarchical to a flatter level positively influences KS-driven performance within the organization (Grant, 1996; Nonaka & Takeuchi, 1995).

Unlike centralization, the decentralized structure significantly influences interdepartmental communication and KS practices that positively align organizational performance (Hurley & Green, 2005). Therefore, Gold et al. (2001) pointed out that a flexible and informal structure facilitates more knowledge sharing practices as compared to a centralized structure. Similarly, Syed-Ikhsan and Rowland (2004) indicated that a flexible structure influences KS practices by motivating the employees to share knowledge more willingly. Drawing upon the above discussion, this study formulates the following hypotheses:

H_{14}: KS practices positively influence decentralization.
H_{15}: Decentralization positively influences firm performance.
H_{16}: Decentralization mediates the relationship between KS practices and firm performance.

Technology Infrastructure, Knowledge Sharing and Performance

Information Technology (IT) infrastructure is an essential strand of KS practices within the organization (Sridharan, 2002; Nishimoto & Matsuda, 2007; Harrison & Daly, 2009; Ryan et al., 2010; Ho et al., 2012; Abouzeedan & Hedner, 2012; Zhang & Jasimuddin, 2012). The use of Information Communication Technologies (ICTs) is embedded in an organization in the form of business communication networks, technologies, software, tools and databases that facilitate in KS practices within the organization (Ababneh & Hatamleh, 2013).

IT's contribution is worthwhile for an organization's performance, but the trend has shifted towards the formation of IT enabled capabilities for working in a highly competitive environment (Patrakosol & Lee, 2009; Bharadwaj, 2000; Santhanam

& Hartono, 2003; Ashrafi & Mueller, 2015). IT infrastructure such as ICTs, e-mail, video link-based meetings, expert systems, information decision support systems and internal portals are indispensable enablers for knowledge creation and sharing (Sharratt & Usoro, 2003). Therefore, the role of IT infrastructure is critical as it diminishes the cost of time and distance that increases the efficiency of knowledge transmission and sharing (Albino et al., 2001; Cabrera et al, 2006; Kwan & Cheung, 2006). Gouza (2006) illustrated that technology removes the barriers for KS, where IT driven face to face interaction increases KS practices amid the employees. Moreover, effective IT infrastructure is a source of collaborative learning and removes the barriers hindering communication and collaboration within the organization (Ngoc, 2005; Lee & Choi 2003).

IT infrastructure is an important enabler for KM driven initiatives (knowledge acquisition, transfer, application and sharing) that enables individuals and organizations to reconfigure their knowledge for productive means (Reychav & Weisberg, 2010; Devenport & Prusak, 1998). Prior research highlighted both the direct impact (Mata et al., 1995; Ross et al., 1996; Powell & Dent-Micallef, 1997) and the indirect impact (Tippins & Sohi, 2003; Piccoli & Ives, 2005; Pavlou & El-Sawy, 2010; Nevo & Wade, 2010) of IT on firm performance. Thus, IT is a fundamental source of organizational performance and sustainable competitive advantage (Bhatt & Grover, 2005; Seleim & Khalil, 2007).

H_{17}: KS practices positively influence the IT infrastructure.
H_{18}: IT infrastructure positively influences firm performance.
H_{19}: IT infrastructure mediates the relationship between KS practices and firm performance.

Research Methodology

Software sector is the critical driver of knowledge economy. The employees working in IT and software houses are known as knowledge workers with multiple knowledge process capabilities and resources. According to the Punjab Software Export Board, presently more than 4500 software houses are operating in Pakistan with a combined worth of USD 6.5 billion. A number of foreign players like Teradata, TRG global, S&P global and Net SoL from China, Germany, USA and Spain are operating in Pakistan. The current study used an amended instrument with a convenient sampling approach to collate data from knowledge workers (software developers and programmers) working in the software sector of Pakistan. To obtain the essential objectives of the study, 750 questionnaires were distributed using the postal service and were self-administered. A total 612 responses were considered

for analysis and the remaining responses were discarded due to being incomplete and identical. This presents a 70.99% response rate.

A five-point Likert scale ranging from 1-5 (5= strongly agree to 1= strongly disagree) was utilized. The instrument used in the current study has two main parts: the first part gathers information about the demographic characteristics of the respondents, while the second part gathers information about predictors, outcomes and mediating variables. This study utilized 11 items for measuring KS practices among knowledge workers employed in the software sector of Pakistan. These items were adapted from the study of (Wang et al., 2014; Wang & Wang, 2012). After exploring enormous prior researches, we used the three dimensions of KM process capabilities namely knowledge acquisition, knowledge application and knowledge protection (Gold et al., 2001; Alavi & Leinder, 2001; Tanriverdi, 2005). Knowledge acquisition was measured using three items, while knowledge application and protection were measured using four items each. Organizational culture, structure (decentralization) and information technology are the important strands of KM infrastructure capabilities (Lee & Choi, 2003). Six items were used for measuring organizational culture, four for measuring centralization and five items were used for measuring information technology. All the measurement items were adapted from the work of (Lee & Choi, 2003). The overall performance of the software sector was evaluated using two important indicators, that is, financial performance (operational excellence and financial achievements) and non-financial performance (customer intimacy and product leadership). The measurement items of these constructs were adopted from the available literature (Zack et al., 2009).

Findings and Analysis

Table 1 demonstrates the demographics of the respondents. Table 2 shows the mean values, standard deviation and the results of the reliability and validity of the instrument used in this study to gather data. For convergent validity, factor loading values were estimated that should be significant at equal or above than 0.5 (Hair et al., 1998). Moreover, the AVE (average variance extracted) for each measurement scale should be larger than 0.5 and the reliability value of Cronbach's alpha (α) should be above 0.70 (Pallant, 2020). The outcomes given in Table 2 portray that the convergent validity for all measurement items is larger than 0.5 and the average variance extracted lies between 0.702-0.834, which meets the acceptability criteria. Table 3 demonstrates the correlation among constructs and also the discriminant validity. According to Wang et al. (2014), if the square root of AVE for every calculated variable is greater than the squared correlation amidst the different constructs, it represents the presence of discriminant validity.

Table 1

Demographics of the Respondents

Demo-graphics	Items	Freq.	%age
Ownership	Private	412	67.3
	Public	144	23.5
	Foreign	56	9.2
Annual Revenue	< 50M	268	43.8
	50-100M	214	35.0
	100-500M	74	12.1
	500-1000M	38	6.2
	>1000	18	2.9
No. of Employees	<100	454	74.2
	100-300	105	17.2
	300-1000	17	2.8
	1000-3000	35	5.7
	>3000	1	.2
Work Experience	1-10	469	76.6
	10-20	133	21.7
	20-30	8	1.3
	>30	2	.3
Education Level	Graduate	402	65.7
	Master	199	32.5
	PhD	8	1.3
	Post-Doc	3	.5
Management Position	Middle	508	83
	Top	104	17

The Parallel Multiple Mediation model (see Fig. 1) proposed and tested using process macro was utilized (Hayes, 2013). The purpose of this model is to examine the extent to which KS practices affect the overall performance of an organization through knowledge process capabilities (knowledge acquisition, application and protection) and knowledge infrastructure capabilities (organizational culture, decentralization and technological infrastructure). This model accounts for two or more mediators and also allows the scholars to examine the unique indirect effect of each mediator through co-variation, while controlling for other indirect effects

(Hayes, 2013). In this study, indirect effects for the model were calculated using 95% confidence interval generated from 50,000 bias-corrected bootstrap samples.

Table 2

Descriptive Analysis, Factor Loading, Cronbach's Alpha and AVE

Constructs	Items	Mean	S.D.	Factor Loading	α - C	AVE
KS*	11	3.682	1.272	0.723, 0.774, 0.812, 0.780, 0.825, 0.704, 0.706, 0.701, 0.801,0.767, 0.756	0.838	0.761
K_{ac}*	3	3.364	1.411	0.841, 0.824, 0.838	0.782	0.834
K_{app}*	4	3.924	1.078	0.802, 0.799, 0.825, 0.784	0.816	0.802
K_{pr}*	4	3.853	1.102	0.807, 0.822, 0.829, 0.822	0.837	0.820
OC*	6	3.939	1.052	0.819, 0.849, 0.853, 0.828, 0.813, 0.837	0.869	0.777
Dec*	4	3.623	1.166	0.809, 0.748, 0.785, 0.779	0.829	0.814
IT*	5	3.919	1.051	0.774, 0.813, 0.703, 0.762, 0.814	0.869	0.810
OP*	12	3.884	1.135	0.672, 0.681, 0.705,0.691, 0.708, 0.725, 0.691, 0.676, 0.723, 0.727, 0.729, 0.696	0.906	0.702

Note. *Legends Presents: KS= Knowledge Sharing, K_{ac}=Knowledge Acquisition, K_{app}= Knowledge Application, K_{pr}= Knowledge Production, OC= Organizational Culture, Dec= Decentralization, IT= Information Technology, OP= Overall Performance

Table 3

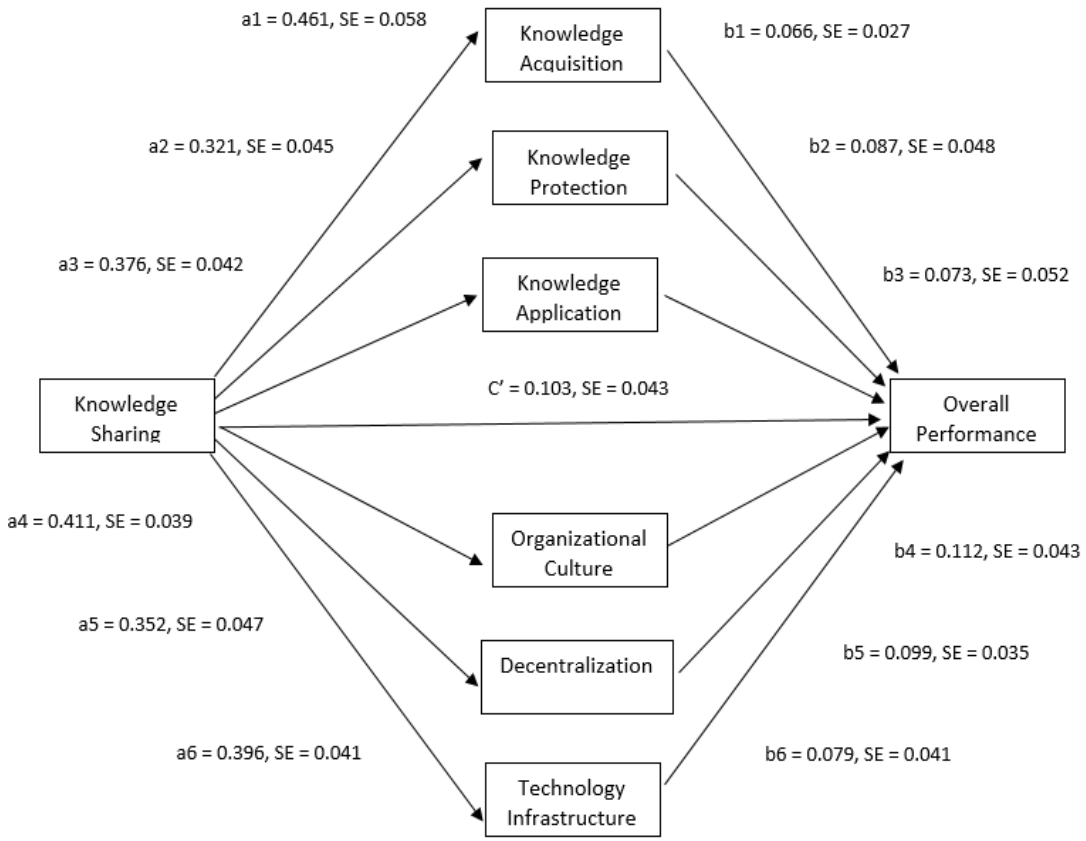
Correlation and Discriminant Validity

Constructs	KS	K_{ac}	K_{app}	K_{pr}	OC	Dec	IT	OP
KS	0.859							
K_{ac}	0.237**	0.913						
K_{app}	0.211**	0.194**	0.905					
K_{pr}	0.277**	0.228**	0.741**	0.895				
OC	0.312**	0.330**	0.354**	0.399**	0.881			
Dec	0.224**	0.207**	0.326**	0.371**	0.328**	0.902		
IT	0.312**	0.234**	0.319**	0.356**	0.431**	0.416**	0.90	
OP	0.242**	0.245**	0.311**	0.328**	0.326**	0.301**	0.299**	0.80

Figure 1 illustrates that KS practices are detrimental to KM success factors which further influence the performance of the software sector. Therefore, it is noted that KS practices positively and significantly ($p<0.01$) influence all the constructs of knowledge process and infrastructure capabilities, thus supporting the suggested hypotheses (see Table 4). Further, the results also indicate that all constructs of knowledge process (knowledge acquisition, application and protection) and infrastructure capabilities (organizational culture, decentralization and technology infrastructure) significantly ($p<0.001$) and positively augment the overall performance of firms (coefficients ranging from 0.066 to 0.112).

Figure 1

Parallel Multiple Mediation model showing the direct and indirect effect of knowledge sharing on overall performance through the critical success factors of KM (KM process capabilities and KM infrastructure)



Mediation Analysis: To scrutinize the mediation analysis, the direct impact of KS practices on firm performance was explored. Next, the impact of KS practices through various meditators (KM critical success factors) on firm performance was investigated. Table 4 presents the summary of the total effect, direct effects, indirect effects, standard errors, and bootstrapped confidence intervals of the proposed model. Table 4 shows the evidence of direct effects for KS practices on firm performance that is statistically significant at ($p<0.05$) with beta value ($c' = 0.10$, SE = 0.04). Next, the indirect effects of KS practices on firm performance mediated through the KM success factors (K_{Ac}, K_{App}, K_{Pr}, OC, Dec, Tech) were also found to be significant. The values of all bias-corrected confidence intervals were not zero. The indirect effects for each of these mediators ranged from 0.028 to 0.046. Hence, there lies a partial mediating relation among KS practices and the performance of the software sector.

Table 4

Direct and Indirect Effects

	B	S.E	*t*-value	*p*-value	LLCI	ULCI	Hypotheses
Total effect							
KS → Perf	0.30	0.04	7.60	0.000	0.22	0.38	-----
Direct Effect							
KS → Perf	0.10	0.04	2.41	0.016	0.019	0.187	H_1 Supported
KS → K_{Ac}	0.46	0.06	7.90	0.000	0.346	0.575	H_2 Supported
KS → K_{App}	0.38	0.04	8.88	0.000	0.293	0.460	H_5 Supported
KS → K_{Pr}	0.32	0.04	7.11	0.000	0.232	0.409	H_8 Supported
KS → OC	0.41	0.04	10.49	0.000	0.334	0.488	H_{11} Supported
KS → Dec	0.35	0.05	7.46	0.000	0.260	0.445	H_{14} Supported
KS → IT	0.40	0.04	9.59	0.000	0.315	0.477	H_{17} Supported
K_{Ac} → OP	0.07	0.03	2.49	0.013	0.014	0.119	H_3 Supported
K_{App} →OP	0.07	0.05	1.41	0.015	0.029	0.176	H_6 Supported
K_{Pr} → OP	0.09	0.05	1.82	0.009	0.007	0.181	H_9 Supported
OC → OP	0.11	0.04	2.60	0.009	0.027	0.196	H_{12} Supported
Dec→ OP	0.09	0.04	2.81	0.005	0.030	0.167	H_{15} Supported
Tech → OP	0.08	0.04	1.93	0.003	0.001	0.159	H_{18} Supported

	B	S.E	*t*-value	*p*-value	LLCI	ULCI	Hypotheses
Indirect Effect (Bias-corrected 95% confidence intervals from 50,000 bootstrap samples)							
KS → K_{Ac} → OP	0.031	0.01			0.006	0.059	H_4 Supported (Partial Mediation)
KS → K_{App} → OP	0.028	0.03			0.022	0.077	H_7 Supported (Partial Mediation)
KS → K_{Pr} → OP	0.028	0.02			0.015	0.072	H_{10} Supported (Partial Mediation)
KS → OC → OP	0.046	0.02			0.008	0.088	H_{13} Supported (Partial Mediation
KS → Dec → OP	0.035	0.01			0.010	0.061	H_{16} Supported (Partial Mediation
KS → Tech → OP	0.031	0.02			0.000	0.068	H_{19} Supported (Partial Mediation

Discussion

This research proposed a model that explains how KS practices are detrimental for boosting the performance of software firms via the mediating role of the critical success factors of KM. Consistent with the previous notions (Rehman et al., 2015; Wang et al., 2014; Palacios-Marqués et al., 2013; Wang & Wang, 2012), the results of the current study revealed that KS practices positively stimulate the performance of the software sector and remain a source of competitiveness (Gao et al., 2009). Nevertheless, the results of this study also indicated that KS practices not only directly improve the overall performance of firms but also indirectly influence the performance of the software sector through reinforcing the role of the critical success factors of KM. Thus, the results of the study underpinned the theoretical prism of KBV and suggested that KS practices through both formal (documents, policy, manuals) and informal (implicit) procedures (social interactions, networking) improve the performance of this sector in terms of business processes,

dependability of operational process and financial achievements (Gao et al., 2009; Matthew & Sternberg, 2009; Akbar, 2003; Islam et al., 2015).

The results also demonstrated that KM process capabilities (knowledge acquisition, application and protection) partially mediate the performance of the software sector (Rehman et al., 2015; Van den Hooff & De Ridder, 2004). These findings revealed that KS practices are a source for employees to share their past failures in order to improve their future course of action and strategies. This is achieved through the creation of innovative knowledge and its application in business processes (development of integrated and customized software) that tends to enhance the performance of this sector.

The findings also provided valuable insights for both formal (documents and meetings) and informal (expertise and skills) KS interactions encouraged by the KM infrastructure capabilities (organizational culture, decentralization and technology) (Rehman et al., 2015; Wang et al., 2014). Such interactions show that knowledge within an organizational setup is shared more frequently.

This research postulates that supportive KM infrastructure capabilities (culture, decentralization, technology infrastructure) partially mediate KS driven performance, both explicitly and implicitly (Gold et al., 2001; Janz & Prasarnphanich, 2003; Zack el al., 2009; Mills & Smith, 2011; Islam et al., 2015). It indicates that the acquisition of effective KM infrastructure is inevitable to influence the performance of firms. This finding points to the fact that organizational culture, employee participation in decision-making and IC supportive technology infrastructure enables knowledge workers to effectively share knowledge with each other (Hurley & Green, 2005).

Conclusion and Implications

The foremost objective of the current study was to investigate the role of knowledge sharing (KS) practices in the overall performance of the software sector using the critical success factors of knowledge management (KM), that is, knowledge process and infrastructure capabilities as intermediate measures. The study revealed that KS practices positively influence the performance of the software sector (Rehman et al., 2015, Wang et al., 2014; Wang & Wang, 2012). Further, the indirect impact of KS practices is partially mediated by the critical success factors of KM (KM process and infrastructure capabilities).

Due to the transient nature of knowledge, it is pertinent to revolutionize organizational knowledge within the software industry to upgrade the course of action, strategies, processes and infrastructures capabilities. In this regard, this

study is creative and contributes to the theoretical underpinning of KBV. In the same vein, it also contributes to the scarce literature on KS.

Furthermore, this study has several practical implications. Its findings will help knowledge workers understand the importance of KS process and infrastructure capabilities. Hence, the level of KS practices and supportive knowledge process capabilities will enable knowledge workers to cater the emerging needs of this sector, especially in terms of mobile application development, big data analysis, cloud computing and responsive web knowledge applications.

Limitations and Directions

This study delineates the path for future research albeit in view of some inherited limitations. Firstly, this research was conducted with a cross-sectional research design. Future research must incorporate some useful insights using the longitudinal research design. Secondly, this research draws inference from the software sector. Future research can be conducted on other knowledge oriented sectors such as information communication technologies (ICTs), chemical and pharmaceutical sectors. Lastly, this research focuses on the mediating roles of two KM critical factors (KM process and infrastructure) only. Future studies must explore the role of KM strategy as a mediator and the perceived cost of KS as a moderator within a dynamic organizational and cultural context.

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