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The effects of socio-technical enablers on knowledge sharing: an exploratory examination

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Abstract.

Recently, the need for knowledge management has been drastically increasing so organizations may meet the high level of dynamic, complex business change and uncertainty. In particular, knowledge sharing has been recognized as a critical process through which organizational knowledge can be utilized. For successful knowledge sharing, companies need to capitalize on various socio-technical enablers. The primary objective of this paper is to provide a better understanding of how these enablers can affect knowledge sharing intention and behavior, and explore practical implications for knowledge sharing. For this purpose, the paper proposes a theoretical model to investigate these enablers from a socio-technical perspective. PLS (Partial Least Square) analysis was employed to validate the model. This field study involves 164 users. Furthermore, interviews with experts were investigated for practical implications. Our analysis reveals that social enablers such as trust and reward mechanisms are more important than technical support in isolation for facilitating knowledge sharing.

Keywords: knowledge management; knowledge sharing; socio-technical perspective

1. Introduction

Organizations have recognized that organizational knowledge can play an essential role in responding to the severe competition in today's knowledge economy. For a growing number of companies, competitive advantage lies in the capability to create ideas and intellectual know-how. Looking for breakthroughs or just trying to improve their processes, organizations will benefit from valuable knowledge assets when judiciously employed. A variety of studies have discussed the importance of knowledge as a primary resource to keep competitive advantage [1–5]. For managing organizational knowledge, companies have adopted various knowledge management (KM) practices to encourage people participation [6]. They are implementing KMSs (knowledge management

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systems) to utilize their knowledge. Several companies such as Anderson Consulting, Buckman Laboratory, and 3M, which are famous for successful knowledge management, have fostered knowledge intensive teams such as communities of practice based on robust KMSs. These companies illustrate the importance of knowledge management by embracing best practice and expertise beyond the organizational unit to resolve business problems and seek new business opportunities [4, 6, 7]. Evidence is emerging about the KM edge.

As a number of organizations have conducted KM practices in real business fields, knowledge sharing increasingly becomes a subject of great interest to both KM academicians and practitioners. An organization's ability to leverage its knowledge is highly dependent on its people, who actually share knowledge [8]. A growing interest in knowledge management has made it important to understand how individual members share their knowledge within their groups, and across organizational units or hierarchical levels. The movement of knowledge across individuals and organizational boundaries is ultimately dependent on employees' knowledge sharing behaviors [9]. Particularly, sharing employees' expertise and skills provides opportunities for mutual learning, and contributes to organizational capabilities to innovate [10, 11]. Knowledge sharing among individuals with different domains and expertise can create organizational knowledge that is beyond what one individually owns. Individuals who share organizationally relevant information, ideas, suggestions, and expertise with one another would be able to jointly create new knowledge [12], which helps convert individual knowledge into economic and competitive value for the organization [13]. Therefore, knowledge sharing at the individual level would be a basic step toward creating organizational knowledge.

Researchers have sought to recommend strategies so that organizations can investigate different ways in which employees can share and leverage their knowledge [3]. Typically, many business leaders tend to believe that KM success depends on the KMS in isolation. However, the most important value comes when their decisions make the people and the organization they lead move in the right direction. While much of KM literature heavily focuses on technical issues at the initial stage, the importance of human and social factors has been increasingly growing [7, 13–17]. To our best knowledge, there is little research considering both social and technical viewpoints with empirical evidence.

Therefore, the emphasis of this paper is on developing a conceptual foundation to explain knowledge sharing from the socio-technical perspective. Lurking are strategic decisions that can nurture the enablers to link knowledge sharing to business performance. For this purpose, this paper attempts to propose a model to underpin knowledge sharing enablers and validate them. Correspondingly, the findings will be able to reveal the way to employ these enablers to facilitate knowledge sharing.

2. Knowledge sharing and related studies

Knowledge sharing is a multi-dimensional activity and thus involves several contextual, cognitive, and communicative skills [4, 18, 19]. A growing body of research has addressed the enablers that facilitate willingness to share knowledge from various perspectives. Specifically, researchers in information systems (IS) and organizational fields have made efforts to theorize these enablers and link them to knowledge sharing behaviors. In addition, several studies focus on knowledge sharing from the technical perspective [20, 21]. Their emphasis is on providing guidelines for implementing knowledge management systems. In contrast, the studies from the social perspective attempt to investigate cultural or motivational factors. Some of them are summarized as shown in Table 1. They can be explored further as follows.

Several studies have found that social factors such as trust, expertise, and rewards are imperative to explain knowledge sharing behavior. Based on TRA (Theory of Reasoned Action), some of them posited that knowledge sharing intention has a strong association with knowledge sharing behavior [2, 22, 24]. Specifically, it is noted that strong trust increases good will among employees [23] and plays a critical role in reciprocal transactions based on the social capital theory [5, 19].

Table 1
Summary of the studies on knowledge sharing

Perspective	Research	Method	Key findings
Social	Bartol & Srivastava (2002) [1]	Conceptual	The role of reward systems in knowledge sharing
	Ryu et al. (2003) [22]	Empirical	Knowledge sharing based on TRA model in terms of expertise group (physicians in hospital)
	Abrams et al. (2003) [23]	Empirical	The role of interpersonal trust within the context of trust
	Widén-Wulff & Ginman (2004) [19]	Conceptual	Antecedents of knowledge sharing based on social capital dimension
	Bock et al. (2005) [2]	Empirical	Knowledge sharing behaviors from a social-psychological perspective; the emphasis on negative effect of extrinsic reward
	So & Bolloju (2005) [24]	Empirical	Knowledge sharing and reuse based on TRA model within the context of IT service operation
	Wasko & Faraj (2005) [5]	Empirical	Knowledge sharing in electronic network based on social capital theory
Technical	Hendricks & Vriens (1999) [13]	Conceptual	The role of KMS based on two-factor theory
	Hendricks (1999) [21]	Conceptual	The trade-off of IT system for knowledge sharing
	Alavi & Tiwana (2001) [14]	Conceptual	The role of KMS for integrating knowledge within the context of a virtual team
	Huysman & Wulf (2006) [25]	Conceptual	The role of IT for knowledge sharing based on social capital theory
	Sherif et al. (2006) [26]	Case study	The role of KMS for building social capital within the context of a global IT company
Integrated	Pan & Scarbrough (1998) [6]	Case study	An examination of knowledge sharing at Buckman Lab. from a socio-technical perspective
	Hall (2001) [15]	Conceptual	The strategies for making input-friendly intranets for knowledge sharing
	Ipe (2003) [8]	Conceptual	An integrative model of knowledge sharing by combining three factors such as type of knowledge, motivation to share, and opportunities to share
	Yang & Chen (2007) [27]	Empirical	The impact of organizational knowledge capabilities on knowledge sharing behavior

Although some studies suggest that monetary value is indispensable to knowledge sharing, others have argued that this tangible reward in isolation is not sufficient to motivate knowledge sharing among individuals. Most studies propose that intrinsic reward may be more important than extrinsic reward for diffusing knowledge [1, 19]. Furthermore, it has been noted that occasionally extrinsic rewards have a negative effect on knowledge sharing. For instance, the work of Bock et al. [2] empirically examined this negative effect of monetary value on knowledge sharing intention.

From the technical perspective, IT may be one of the important factors that affect successful knowledge sharing. Typically, KMSs have been used for transferring explicit knowledge to other members in organizations beyond location and time [14]; i.e. several studies have highlighted its positive effect. KMS can help facilitate the efficient sharing of a firm's intellectual resources. In particular, Huysman and Wulf [25] discussed how IT can support knowledge sharing in communities based on the social capital theory. In contrast, it is also noted that IT tools such as intranets and knowledge base, which are geared towards codifying knowledge, may not be effective enough [21]. Thus, several KMS studies highlighted the role of social capital in organizations [26]. Hendricks and Vriens [13] asserted a shift of focus from technical implementation in isolation to specific challenges and problems within a knowledge-based organization.

From the integrated perspective, researchers began to consider both social and technical factors. For example, Pan and Scarbrough [6] applied this integrated framework to a particular company. Hall [15] investigated the antecedents including intranet system, critical mass, enabling conditions, and reward systems. Similarly, Ipe [8] presented a conceptual model to incorporate three primary factors

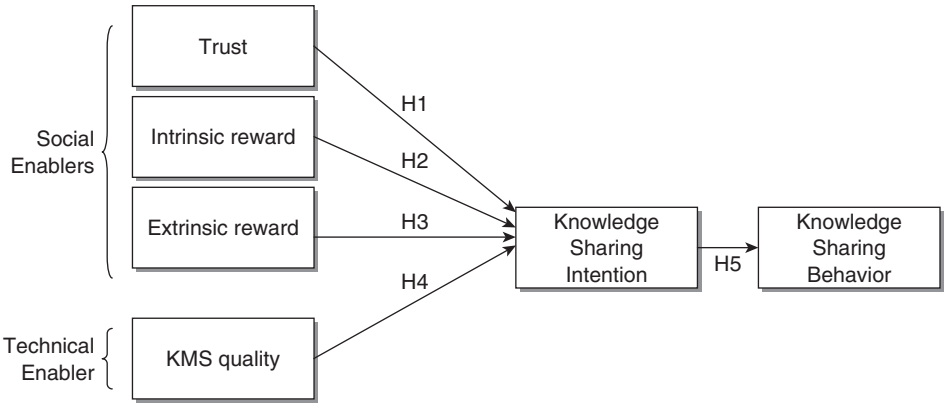

Fig. 1. Research model.

such as type of knowledge, motivation to share, and opportunities to share. Interestingly, Yang and Chen [27] examined the impact of organizational capabilities including cultural, structural, human, and technical knowledge on knowledge sharing behavior from the resource based perspective.

Yet, to our best knowledge, there is little empirical evidence for the socio-technical enablers. This lack of evidence drives us to look further into knowledge sharing to understand why some successful companies can obtain distinct advantages.

3. Research model

A variety of social and technical enablers facilitate knowledge sharing [1, 8]. They interact complementarily to shape knowledge management efforts [6, 28, 29]. This interaction needs to consider sociability, usability, and the fit between social and technical factors [30]. Socio-technical studies usually focus on the continuous interactions between IT and people during the design, implementation and use of IT systems [25]. Specifically, they adopt a holistic approach that can highlight the interplay of social and technical factors in the way people work. Therefore, an organization should consider both factors, and dynamic business processes require their synergy; this synergy is found to result in better performance [3, 31].

In a similar vein, this paper proposes a research model as shown in Figure 1. The objective of this model is not to delineate all inherent enablers. Instead, our model highlights a few key factors that can explain a large portion of the variance in knowledge sharing. This integrated model is more likely to help in investigating various enablers to decipher knowledge sharing activities. Our model posits that knowledge enablers affect knowledge sharing intention and behavior. Our analysis is based on the individual level. Understanding knowledge sharing between individuals can lead to a better understanding of knowledge sharing as a whole in an organization.

4. Hypothesis development

Companies embrace organizational characteristics such as culture, structure, or people [4, 6, 19]. Among these social enablers, trust is difficult to acquire and complex to imitate [32]. Trust is defined as a set of expectations shared by all those in an exchange; it is a multi-faceted concept that can be conceptualized across three dimensions such as integrity, benevolence, and competence. In particular, trust has been an important factor to consider in organizational and IS literature on knowledge sharing [8, 15, 20 , 33]. When employees believe that their relationships are high in trust, they tend to become interested in knowledge exchange and social interaction [34]. Hence, we hypothesize:

H1: Trust is positively associated with knowledge sharing intention.

A reward system can motivate employees to concentrate their efforts in achieving common organizational goals. Rewards range from extrinsic incentives such as bonuses to intrinsic rewards such as praise and public recognition. This can encourage employees to participate in communities of practice and donate their own expertise. Significant changes may be required in the incentive system to encourage individuals to share their knowledge [1, 15]. Extrinsic rewards seem to be relatively easier to acquire than intrinsic rewards [1, 5]. The relationship between extrinsic and intrinsic rewards has been controversial. Even though most previous studies have highlighted the importance of extrinsic rewards, some researchers have suggested that intrinsic rewards would be more critical in knowledge sharing [1, 2, 35]. To be clear, both extrinsic and intrinsic rewards would enhance knowledge sharing intention. Therefore, we hypothesize:

H2: Intrinsic reward is positively associated with knowledge sharing intention.
H3: Extrinsic reward is positively associated with knowledge sharing intention.

Knowledge needs to be communicated; knowledge may result from connecting employees through the use of electronic communication tools [25, 36]. A KMS is an example of a technical knowledge enabler. It is an IT-based system developed to support the organizational processes of knowledge creation, storage/retrieval, transfer, and application [14]. A KMS differs from other information systems because it stores and handles knowledge rather than information and thus requires functions such as knowledge repository, video conference, and search engines. For example, a knowledge repository system plays an important role in sharing explicit knowledge and the outcomes of knowledge transfer [10]. Moreover, KMS can also support complex knowledge sharing activities to enhance communication and encourage employees to share their implicit knowledge in organizations [26]. It may thus foster knowledge sharing in informal interactions with or across teams or work units. For example, these kinds of interaction can happen within electronic communities of practice, which are voluntary forums of employees focusing on a topic of interest [37]. To encourage knowledge sharing beyond the organizational boundary, a KMS should provide appropriate functions with excellent qualities [15, 20]. KMS quality is an enhanced construct that originates from system quality in the IS field [38]. KMS quality may include availability, ease of use, stability, and response speed. Accordingly, we hypothesize:

H4: KMS quality is positively associated with knowledge sharing intention.

Willingness to share is related with the contingent way of knowledge sharing behavior. Several studies provide an empirical validation that knowledge behavior is mediated by a sharing attitude (for example [19, 22]) Even though each employee has willingness to share, he/she may not share knowledge. To distinguish these related but equivalent concepts, several studies have proposed knowledge sharing models based on TRA [2] and a number of these studies have reported a strong and significant causal link between behavioral intention and targeted behavior [22, 39]. Accordingly, we advance the last hypothesis:

H5: Knowledge sharing intention is positively associated with knowledge sharing behavior.

5. Research methodology

5.1. Data collection

The data for this study was collected from the firms through the Knowledge Management Research Centre (KMRC) at KAIST (Korea Advanced Institute of Science and Technology). Typically, the corporate members of KMRC have been involved in knowledge management practices for several years. These participating companies have their own KMSs. They have also managed communities of practice. This study conducted a survey with two manufacturing companies among these corporate members. Questionnaires were administered to 200 employees in two companies, from which a total of 176 usable responses were gathered giving a response rate of 82 percent. Incomplete questionnaires

Table 2
Profile of respondents

Measure	Items	Frequency	Percent (%)
Work experience	0–3 yr	63	38.4
	3–6 yr	52	31.7
	6–9 yr		
	9–12 yr	18	11.0
	10– yr	7	4.3
	Missing	24	14.6
Gender	Male	125	76.2
	Female	22	13.4
	Missing	17	10.4
Position	Employee	113	68.9
	Chief	11	6.7
	Manager	14	8.5
	Director	3	1.8
	Others	23	14.0

were discarded, leaving an analysis sample of 164. A high response rate was possible through the support of the companies' knowledge management teams, which distributed the questionnaires and sent emails to encourage participation. A Mann–Whitney U test confirms that there is no statistically significant difference between samples from two companies ($p < 0.01$) [40]. Table 2 shows the demographic profile of the respondents.

5.2. Measurement

The survey items were derived based on the pre-examined measurements from the previous studies. We interviewed team leaders or managers to verify the validity of these items. The final questionnaire consists of the items for knowledge enablers, knowledge sharing intention and behavior, according to a seven-point Likert scale. For further details on the questionnaires and operational definition for the constructs, readers can refer to Appendix 1.

6. Analysis result

In order to validate our model, this paper employs the partial least squares (PLS) technique which is widely used in the IS field. PLS can model latent constructs as either formative or reflective indicators. It makes minimal demands in terms of the sample size in order to validate a model, compared with other structural equation modelling techniques [41]. PLS can handle research models with formative constructs and a relatively small sample size. Also, it does not require multivariate normality distributions for the underlying data. From the practical perspective, it is believed that PLS is superior to LISREL although LISREL is superior on statistical grounds [42].

PLS simultaneously models structural and measurement paths [43]. The recommended sample size in PLS is at least 10 times the number of independent variables. There are two steps in the process of theory testing:

1. developing valid measures of theoretical constructs and
2. testing the relationship between theoretical constructs.

In particular, the PLS Graph Version 2.91 was used in our analysis.

Table 3
Results of confirmatory factor analysis

Measures		Number of items	Composite reliability	Average variance extracted
Social enablers	Trust (TR)	4	0.942	0.764
	Intrinsic reward (IR)	4	0.933	0.777
	Extrinsic reward (ER)	4	0.948	0.819
Technical enabler	KMS quality (KSQ)	4	0.885	0.658
Knowledge sharing intention (KSI)		4	0.924	0.751
Knowledge sharing behavior (KSB)		5	0.904	0.703

6.1. Testing the measurement model

The test of the measurement model includes the estimation of internal consistency, and the convergent and discriminant validity of the instrument items. The convergent and discriminant validity are assessed by construct validity testing. Typically, the construct validity of the proposed model is estimated by item reliability and average variance extracted (AVE) [44, 45]. AVE measures the amount of variance that a latent variable component captures from its indicators relative to the amount due to measurement error. All item reliabilities are higher than the 0.70 cut off value except for KMS quality (0.658). Table 3 shows the details of the validity test results and convergent validity.

Table 4 confirms the discriminant validity; the square root of the average variance extracted for each construct is greater than the level of correlations involving the constructs. The results of the inter-construct correlations show that each construct shares a larger variance with its own measures than with other measures.

6.2. Testing the structural model

The PLS results are depicted in Figure 2. With an adequate measurement model, the proposed hypotheses were tested. Interesting results are obtained from our socio-technical perspective. The findings support our model except for the link between KMS quality and knowledge sharing intention. It is found that knowledge sharing is heavily influenced by the social factors. Clearly, trust has the most significant influence. It is also found that intrinsic reward is more important than extrinsic reward. In contrast, KMS quality is found to be insignificant. Moreover, the strong association between knowledge sharing intention and behavior is confirmed.

Table 4
Correlation between constructs

Variable	TR	IR	ER	KSQ	KSI	KSB
TR	**0.874**					
IR	0.314	**0.881**				
ER	0.332	0.625	**0.905**			
KSQ	0.278	0.396	0.347	**0.811**		
KSI	0.538	0.567	0.502	0.319	**0.867**	
KSB	0.480	0.588	0.530	0.352	0.775	**0.838**

Note: the bold numbers in the diagonal row are square roots of the average variance extracted.

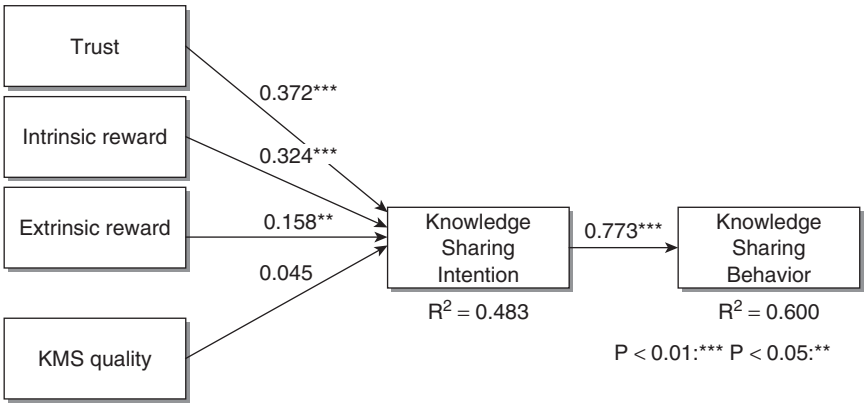

Fig. 2. Analysis results.

6.3. Implications

For a better understanding of individual knowledge sharing, this paper attempts to understand both the social and technical enablers from a socio-technical perspective. Particularly, the primary purpose of this study is to investigate how these knowledge enablers are associated with knowledge sharing. The following points are highlighted from our investigation. First, our results confirm that both intrinsic and extrinsic rewards can facilitate knowledge sharing. Interestingly, the association between intrinsic reward and knowledge sharing is found to be stronger than that between extrinsic reward and knowledge sharing. Recently, many companies have begun to provide extrinsic rewards (for example, gifts, points, or mileage) to employees in order to encourage knowledge sharing. In contrast with the work of Bock et al. [2], our study's result confirmed the positive effect of extrinsic reward. However, although extrinsic reward may be effective in the initial stage of accumulating external knowledge, its effect may become weaker [46]. Our study's result would thus favor the shift from extrinsic rewards to intrinsic rewards as knowledge management practices become mature.

Second, our result confirms the strong effect of trust. If an employee believes in other members' expertise and skills, this increases the intention to share individual knowledge. Trust is likely to help them value highly the benevolence of colleagues in determining the extent to which knowledge is donated or disseminated [23]. Through sheer trust and conviction in those around them, the energy can begin to build. This energy can often lead to the best practice or business opportunities.

Third, KMS quality is found to have an insignificant influence on knowledge sharing intention, which is rather contradictory to our expectation. Recent knowledge management studies indicate that IT can facilitate knowledge sharing (e.g. [3, 47]). Despite this tendency to emphasize the role of IT, however, a growing number of studies have pointed out the importance of the holistic view, which recognizes the interplay between social and technical factors [13, 31, 48]. KMS itself may not be sufficient. Similarly, Lee and Choi [4] noted the relatively weak positive relationship between knowledge creation and IT support. Our finding of the insignificant path from KMS quality to knowledge sharing intention confirms this intriguing point.

Herzberg's theory may help to further sharpen this exploration [21]. Our intention is not to validate Herzberg's theory as a motivational driver, but to use it as an intellectual basis to explain the role of KMS. According to this theory, some factors tend to be related to job satisfaction (motivators), while others are associated with job dissatisfaction (hygiene factors). The theory further suggests that the presence of hygiene factors is necessary, but not sufficient for work satisfaction. When looking for the reason why people want to share knowledge, people almost automatically turn to the motivation factors, not the hygiene factors. Here, a KMS may be regarded as a hygiene factor [21]. That is, a KMS is one of necessities for sharing knowledge; however, it is not likely to be the only key player for enhancing knowledge sharing. Therefore, the analysis result would point out that emphasizing the KMS's quality at the expense of trust or the reward system is not the route to

better knowledge sharing. Instead, organizations should eradicate the impediments to knowledge sharing by providing hygiene factors such as a KMS while being aware that these factors are not sufficient to foster employees' intention to share knowledge. Even though the lack of an excellent KMS may frustrate knowledge sharing, it is not likely that the KMS itself can enhance knowledge sharing behavior [13]. We have to go beyond our tendency to take KMSs for granted.

7. Further exploration

The objective of our socio-technical analysis is to find the way to strike a balance among social and technical subsystems within the company [6]. For further exploration of this interesting finding, we conducted interviews with corporate members at KMRC (Knowledge Management Research Centre) in KAIST. The interviews were performed with KM managers and strategic community of practice (CoP) leaders in two manufacturing companies. Through these meetings, we investigated context-dependent realities. The qualitative results reinforced the findings from our statistical analysis. Interestingly, even though the empirical test could not produce a significant result concerning KMS quality, the interview can confirm that a KMS plays an important role in knowledge sharing as follows.

Specifically, the CoP can be a good alternative for the new wave of KM by creating a balanced interplay between social and technical enablers [49]. Through the interviews, we explored the usability of KMSs in CoP. For example, we interviewed one strategic CoP leader who actively sought to reduce the error rate in assembly lines. Knowledge sharing activities in this strategic CoP were strongly associated with corporate culture and trust among members. The CoP leader explained:

> In our strategic CoP, KMS facilitates communication among our members across various hierarchical levels or job positions. This virtual workplace enhances our intimacy and trust. Our CoP members are involved in the process. We are proud of them for actively sharing their knowledge with other CoP members.

We further interviewed two KM managers in the firms that participated in this survey. One of them remarked:

> For facilitating knowledge sharing, the key enablers may include knowledge sharing culture and trust. Knowledge management practice using KMS creates more flexible work environment. Our workers have used the online board to freely discuss their problems. Furthermore, the IT system can help remove our time and location barriers, and thus knowledge sharing across the location has been increasingly improved.

We were able to find that CoP members are more likely to share on online bulletin boards in a KMS. If the firms facilitate appropriate KMS activities, then employees can easily share information and discuss problems without being hindered by time and location barriers. Finally, based on the above exploration, we can find other enablers such as knowledge sharing culture, organizational support and rule, team culture, and leadership. The effect of those enablers should be examined further and empirically validated.

Lastly, we explored the key issue: which knowledge enablers trigger knowledge sharing intentions? Even though these enablers are necessary for a firms' capability to govern knowledge, it is still unclear how they can be employed in a strategic fashion. Because implementing a knowledge process within a firm can be costly, knowledge sharing should be managed by appropriate KM strategies. Our interview did confirm this strategic importance of KM practices. As found in the empirical test, the interviewees agreed that both human and system-oriented cues should be plugged into the knowledge network.

8. Conclusions

The primary objective of this paper is to decipher the knowledge sharing mechanism from the socio-technical perspective. Our findings are helpful for harnessing knowledge management activities in

an organization. If companies want to succeed in carrying out knowledge management practices, they should consider both social and technical enablers. For example, the system-centric approach is likely to put too much emphasis on explicit knowledge in the knowledge repository system. Similarly, the human-centric approach is prone to lose the chance to capture tacit knowledge due to the difficulty caused by social interaction. Instead, our study's result indicated that the balanced combination of the two approaches leads to better KM strategies. It is like squeezing a balloon in one place only to find that it expands elsewhere. Furthermore, our result tells us that social enablers are likely to be more critical than KMSs for knowledge sharing. For example, trust is the key factor in the individual's decision to share his/her personal knowledge with others. To be clear, KMSs are the basic components for sharing knowledge. Without information technologies, it will not be a trivial task to share and communicate knowledge with other members across time and location.

Several limitations of this study must be recognized. First, we employed the PLS technique because our sample size is rather limited. For further studies with more enablers, we may have to adopt other rigorous methods like LISREL. Second, the current results are derived based on individual features. For a more complete model, we may consider additional antecedents such as organizational culture or structure. Third, because we used cross-sectional data, we might have missed the time lag between knowledge activities and subsequent performance. A longitudinal analysis is of particular interest because the best practices keep evolving. We will therefore report any significant results from these research directions in the near future.

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Appendix 1: survey measurement items

Trust
TR1 I believe that other colleagues are honest and reliable.
TR2 I believe that other colleagues treat each other reciprocally.
TR3 I believe that other colleagues will act in their best interest.
TR4 I believe that other colleagues are knowledgeable and competent in their area.

Intrinsic Reward
IR1 People honor my job when I teach or share my own skills.
IR1 The more I share my own knowledge, the more my reputation would be enhanced.
IR3 When I share my knowledge, I can get more chance to show my skills to the other colleagues.
IR4 When I share my knowledge, people approve me as expert in our team.

Extrinsic Reward
ER1 I receive appropriate monetary value when I transfer my know-how to other colleagues
ER2 I receive points or mileage whenever I upload my document into the system.
ER3 When I share my knowledge, I can get more chance of promotion.
ER4 My company provides gifts or mileage when people put in their knowledge into the organization.

KMS Quality
KSQ1 The KMS is available whenever needed.
KSQ2 The KMS is easy to use for anyone.
KSQ3 The KMS is stable without any interruption.
KSQ4 The KMS provides rapid responses.

Knowledge Sharing Intention
KSI1 I will try to share knowledge.
KSI2 I want to share my own knowledge with more people.
KSI3 Members are willing to explain their know-how, experience or skills.
KSI4 I want to share knowledge with my team members.

Knowledge Sharing Behavior
KSB1 I actually shared know-how with others.
KSB2 I actually shared project documents with others.
KSB3 I actually shared task knowledge with others.
KSB4 I actually shared education results with others.
KSB5 I actually shared operation information with others.

Appendix 2

Construct		Operational definition	Reference
Social enablers	Trust	Maintaining reciprocal faith in each other in terms of intention and behavior	Abrams et al. [23] Lee & Choi [4] Mayer et al. [33]
	Intrinsic reward	Reward that cannot be measured by monetary value such as pride and public recognition	Bartol & Srivastava [1] Bock et al. [2] Ipe [8]
	Extrinsic reward	Reward that can be measured by monetary value such as incentive and bonus	Bartol & Srivastava [1] Bock et al. [2]
Technical enabler	KMS quality	Perceived quality of knowledge management system such as availability, ease of use, stability, and response speed	Alavi et al. [7] Alavi & Tiwana [20] Wu & Wang [38]
Knowledge sharing	Knowledge sharing intention	The intention to provide task information, know-how, and feedback regarding a product or procedure	Bock et al. [2] Ryu et al. [22]
	Knowledge sharing behavior	Behavior of providing task information, know-how, and feedback regarding a product or procedure	Bock et al. [2] Cummings [47] Ryu et al. [22]