



Knowledge sharing and firm innovation capability: an empirical study

Knowledge sharing

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Abstract

Purpose – The study sets out to examine the influence of individual factors (enjoyment in helping others and knowledge self-efficacy), organizational factors (top management support and organizational rewards) and technology factors (information and communication technology use) on knowledge sharing processes and whether more leads to superior firm innovation capability.

Design/methodology/approach – Based on a survey of 172 employees from 50 large organizations in Taiwan, this study applies the structural equation modeling (SEM) to investigate the research model.

Findings – The results show that two individual factors (enjoyment in helping others and knowledge self-efficacy) and one of the organizational factors (top management support) significantly influence knowledge-sharing processes. The results also indicate that employee willingness to both donate and collect knowledge enable the firm to improve innovation capability.

Research limitations/implications – Future research can examine how personal traits (such as age, level of education, and working experiences) and organizational characteristics (such as firm size and industry type) may moderate the relationships between knowledge enablers and processes.

Practical implications – From a practical perspective, the relationships among knowledge-sharing enablers, processes, and firm innovation capability may provide a clue regarding how firms can promote knowledge-sharing culture to sustain their innovation performance.

Originality/value – The findings of this study provide a theoretical basis, and simultaneously can be used to analyze relationships among knowledge-sharing factors, including enablers, processes, and firm innovation capability. From a managerial perspective, this study identified several factors essential to successful knowledge sharing, and discussed the implications of these factors for developing organizational strategies that encourage and foster knowledge sharing.

Keywords Knowledge sharing, Organizational innovation

Paper type Research paper

Introduction

Knowledge sharing creates opportunities to maximize organization ability to meet those needs and generates solutions and efficiencies that provide a business with a competitive advantage (Reid, 2003). Knowledge sharing can define as a social interaction culture, involving the exchange of employee knowledge, experiences, and skills through the whole department or organization. Knowledge sharing comprises a set of shared understandings related to providing employees access to relevant information and building and using knowledge networks within organizations (Hogel



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et al., 2003). Moreover, knowledge sharing occurs at the individual and organizational levels. For individual employees, knowledge sharing is talking to colleagues to help them get something done better, more quickly, or more efficiently. For an organization, knowledge sharing is capturing, organizing, reusing, and transferring experience-based knowledge that resides within the organization and making that knowledge available to others in the business. A number of studies have demonstrated that knowledge sharing is essential because it enables organizations to enhance innovation performance and reduce redundant learning efforts (Calantone *et al.*, 2002; Scarbrough, 2003).

A firm can successfully promote a knowledge sharing culture not only by directly incorporating knowledge in its business strategy, but also by changing employee attitudes and behaviors to promote willing and consistent knowledge sharing (Connelly and Kelloway, 2003; Lin and Lee, 2004). Moreover, various studies focused on the relationship between knowledge sharing enablers and processes (Van den Hooff and Van Weenen, 2004a; Van den Hooff and Van Weenen, 2004b; Bock *et al.*, 2005; Yeh *et al.*, 2006), while others have focused on the relationship between knowledge sharing enablers and innovation performance (Calantone *et al.*, 2002; Syed-Ikhsan and Rowland, 2004). However, researchers and practitioners have not tried an integrative model that explores the effectiveness of knowledge sharing from a holistic perspective, and little empirical research has examined the relationships among knowledge sharing enablers, processes, and firm innovation capability.

To fill this gap, this study develops a research model that links knowledge sharing enablers, processes, and firm innovation capability. The study examines the influence of individual factors (enjoyment in helping others and knowledge self-efficacy), organizational factors (top management support and organizational rewards) and technology factors (information and communication technology use) on knowledge sharing processes and whether leads to superior firm innovation capability. Based on a survey of 172 employees from 50 large organizations in Taiwan, this study applies the structural equation modeling (SEM) to investigate the research model. Additionally, the current study contributes to knowledge sharing research by further clarifying which factors are essential for knowledge sharing effectively. At a minimum, the findings of this study provide a theoretical basis, and simultaneously can be used to analyze relationships among knowledge sharing enablers, processes, and firm innovation capability. From a managerial perspective, the findings of this study can improve understanding and practice of organizational management of knowledge sharing. Specifically, this study identified several factors essential to successful knowledge sharing, and discussed the implications of these factors for developing organizational strategies that encourage and foster knowledge sharing.

Analysis model and hypotheses

Figure 1 illustrates the general framework of strategic decision processes that are contrasted below. Following the approach proposed by Rajagopalan *et al.* (1993), the analytical framework of this study comprises three aspects: enablers, processes and outcomes. "Enablers" are the mechanism for fostering individual and organizational learning and also facilitate employee knowledge sharing within or across teams or work units. In related research, knowledge sharing enablers include the effects caused by employee motivators, organizational contexts, and information and communication

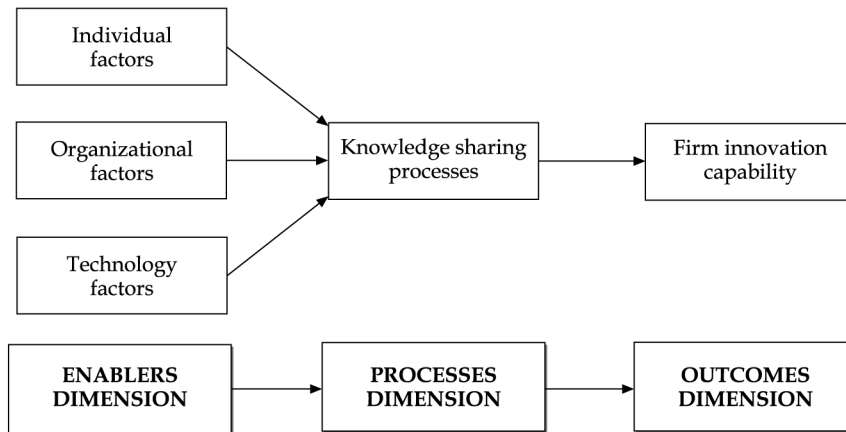


Figure 1.
A general framework for studying knowledge sharing

technology (ICT) applications (Taylor and Wright, 2004; Bock *et al.*, 2005; Wasko and Faraj, 2005; Lin and Lee, 2006). The “knowledge sharing processes” dimension refers to how organization’s employees share their work-related experience, expertise, know-how, and contextual information with other colleagues. Knowledge sharing processes consist of both employee willingness to actively communicate with colleagues (i.e. knowledge donating) and actively consult with colleagues to learn from them (i.e. knowledge collecting). Finally, the organizational promotion of knowledge sharing is changing traditional ideas about managing intellectual resources and employee work styles by providing new processes, disciplines and cultures, thus constituting an organizational innovation (Darroch and McNaughton, 2002). The “outcomes” dimension reveals the effects of the degree of knowledge sharing effectively achieved on firm innovation capability.

The literature recognizes the existence of different influences on employee knowledge sharing activities, such as individual, organizational, and technology factors (Lee and Choi, 2003; Connelly and Kelloway, 2003; Taylor and Wright, 2004). Referring to the individual dimension, most authors agree that knowledge sharing depends on individual characteristics, including experience, values, motivation, and beliefs. Wasko and Faraj (2005) suggested that individual motivators may enable employee willingness to share knowledge. Employees are motivated when they think that knowledge sharing behaviors will be worth the effort and able to help others. Therefore, the expectation of individual benefits can promote employees to share knowledge with colleagues. Furthermore, referring to the organizational dimension, organizational climate is usually made to capture efficiently the benefits of innovation-supportive culture (Saleh and Wang, 1993). In the context of knowledge sharing, the different aspects of organizational climate are critical drivers of knowledge sharing, such as reward systems linked to knowledge sharing (Bartol and Srivastava, 2002), open leadership climate (Taylor and Wright, 2004), and top management support (MacNeil, 2003; MacNeil, 2004). Finally, referring the technology dimension, ICT can be effectively used to facilitate the codification, integration, and dissemination of organizational knowledge (Song, 2002). For example, using ICT, such as groupware,

online databases, intranet, and virtual communities, for communicating and sharing knowledge has been the focus of several previous researches (Koh and Kim, 2004).

Knowledge sharing processes can be conceived as the processes through which employees mutually exchange knowledge and jointly create new knowledge (Van den Hooff and Van Weenen, 2004a). Ardichvill *et al.* (2003) discussed knowledge sharing as involving both the supply and the demand for new knowledge. Van den Hooff and Van Weenen (2004b) identified a two-dimension of knowledge sharing process that consists of knowledge donating and knowledge collecting. Knowledge donating can be defined as the process of individuals communicating their personal intellectual capital to others, while knowledge collecting can be defined as the process of consulting colleagues to encourage them to share their intellectual capital. Additionally, an important challenge for organizations is which motivations influence both knowledge donating and knowledge collecting and lead to superior firm innovation capability (Jantunen, 2005). Therefore, this study focuses on the relationships between knowledge sharing enablers (i.e. individual, organizational, and technology factors) and firm innovation capability by elaborating on the significance of knowledge sharing processes (i.e. knowledge donating and knowledge collecting). Figure 2 illustrates the set of hypotheses considered in the research model that is discussed below.

Individual factors as determinants of knowledge-sharing processes

The research considered here has focused on individual factors that promote or inhibit organizational knowledge sharing activities. The two factors that may be proximal determinants of knowledge sharing are identified: enjoyment in helping others and knowledge self-efficacy. Enjoyment in helping others is derived from the concept of altruism. Organ (1988) defined altruism includes discretionary behaviors that help specific others with organizationally relevant tasks or problems. Knowledge workers may be motivated by relative altruism owing to their desire to help others (Constant *et al.*, 1994; Davenport and Prusak, 1998). Previous research shows that employees are intrinsically motivated to contribute knowledge because engaging in intellectual pursuits and solving problems is challenging or pleasurable, and because they enjoy

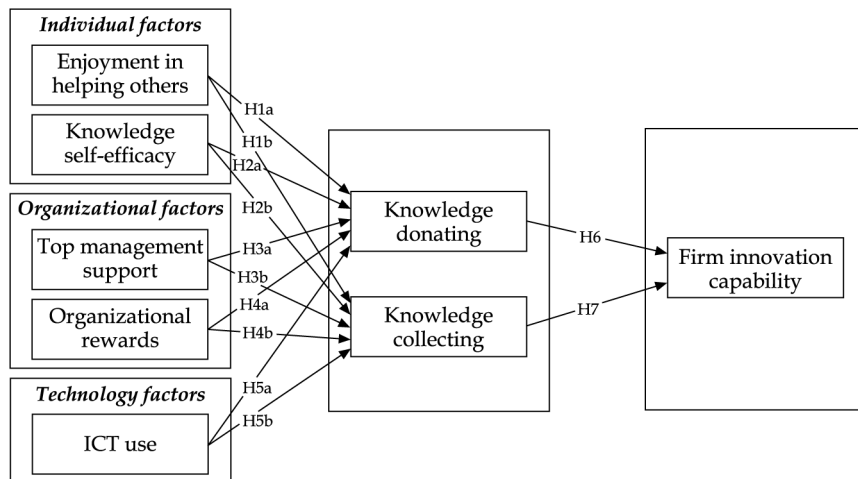


Figure 2.
The research model

helping others (Wasko and Faraj, 2000; Wasko and Faraj, 2005). Knowledge workers who derive enjoyment from helping others may be more favorable oriented toward knowledge sharing and more inclined to share knowledge – in terms of both donation and collecting. The following hypothesis thus is proposed:

- H1.* Enjoyment in helping others positively influences employee willingness to both (a) donate and (b) collect knowledge.

Self-efficacy is defined as the judgments of individuals regarding their capabilities to organize and execute courses of action required to achieve specific levels of performance (Bandura, 1986). Self-efficacy can help motivate employees to share knowledge with colleagues (Wasko and Faraj, 2005). Researchers have also found that employees with high confidence in their ability to provide valuable knowledge are more likely to accomplish specific tasks (Constant *et al.*, 1994). Knowledge self-efficacy typically manifests in people believing that their knowledge can help to solve job-related problems and improve work efficacy (Luthans, 2003). Employees who believe that they can contribute organizational performance by sharing knowledge will develop greater positive willingness to both contribute and receive knowledge. Hence, the following hypothesis is proposed:

- H2.* Knowledge self-efficacy positively influences employee willingness to both (a) donate and (b) collect knowledge.

Organizational factors as determinants of knowledge-sharing processes

Top management support is considered one of the important potential influences on organizational knowledge (Connelly and Kelloway, 2003). Numerous studies have found top management support essential to creating a supportive climate and providing sufficient resources (Lin, 2006). MacNeil (2004) emphasized the importance of the visible top management's support to organizational knowledge sharing climate. Moreover, Lin and Lee (2004) proposed that the perception of top management encouragement of knowledge sharing intentions is necessary for creating and maintaining a positive knowledge sharing culture in an organization. Consequently, this study expects that top management support positively influences employee willingness to share knowledge with colleagues – both in terms of donating and collecting. The following hypothesis is therefore formulated:

- H3.* Top management support positively influences employee willingness to both (a) donate and (b) collect knowledge.

Organizational rewards indicate what the organization values shape employee behaviors (Cabrera and Bonache, 1999). Organizational rewards can range from monetary incentives such as increased salary and bonuses to non-monetary awards such as promotions and job security (Davenport and Prusak, 1998; Hargadon, 1998). Several organizations have introduced reward systems to encourage employees to share their knowledge. For example, Buckman Laboratories recognizes its 100 top knowledge contributors through an annual conference at a resort. Moreover, Lotus Development, a division of IBM, bases 25 per cent of the total performance evaluation of its customer support workers on the extent of their knowledge sharing activities (Bartol and Srivastava, 2002). This study thus expects that if employees believe they can receive organizational rewards by offering their knowledge, they would develop

greater positive willingness to both donate and receive knowledge. The following hypothesis is proposed:

- H4. Organizational rewards positively influence employee willingness to both (a) donate and (b) collect knowledge.

Technology factors as determinants of knowledge-sharing processes

Information and communication technology (ICT) use and knowledge sharing are closely linked, because ICT can enable rapid search, access and retrieval of information, and can support communication and collaboration among organizational employees (Huysman and Wulf, 2006). Within knowledge sharing, the use of ICT development facilitate new methods and applications (such as groupware, online databases, intranet, virtual communities, etc.), and allow firms to expand available social networks by overcoming geographical boundaries and thus achieving more effective collaborative activities (Pan and Leidner, 2003). Moreover, Zack (1999) believes that ICT plays the following three different roles in knowledge management activities:

- (1) Obtaining knowledge.
- (2) Defining, storing, categorizing, indexing, and linking knowledge-related digital items.
- (3) Seeking and identifying related content.

Moreover, according to Yeh *et al.* (2006), effective knowledge management requires employees sharing their knowledge through ICT facilities, because ICT can provide communication channels for obtaining knowledge, correcting flow processes, and identifying the location of knowledge carriers and requesters. Hence, the following hypothesis is proposed:

- H5. ICT support positively influences employee willingness to both (a) donate and (b) collect knowledge.

Knowledge-sharing processes and firm innovation capability

It is obvious that a firm's ability to transform and exploit knowledge may determine its level of organizational innovation, such as faster problem-solving capability and enhanced rapid reaction to new information. Many scholars stress the importance of knowledge sharing to enhancing innovation capability (Liebowitz, 2002; Lin, 2006).

The definition of Davenport and Prusak (1998) indicates that knowledge is personal. Organizations can only begin to effectively manage knowledge resources when employees are willing to cooperate with colleagues to contribute knowledge to the firm. Knowledge donating aims to see individual knowledge become group and organizational knowledge over time, which in turn improves the stock of knowledge available to the firm. A firm that promotes employees to contribute knowledge within groups and organizations is likely to generate new ideas and develop new business opportunities, thus facilitating innovation activities (Darroch and McNaughton, 2002).

Knowledge collecting consists of processes and mechanisms for gathering information and knowledge from internal and external sources. The process of knowledge collecting in which organizational knowledge becomes group and individual knowledge, involves the internalization and socialization of knowledge.

Hansen (1999) suggested that knowledge collecting represents a key aspect of successful project completion, especially for organizations heavily involved in innovation projects. The generation of new ideas and the improvement of firm products, because of a better absorptive capacity, could improve innovation performance (Jantunen, 2005). Specifically, a firm with proficiency in gathering and integrating knowledge is more likely to be unique, rare, and difficult for rivals to replicate, and hence has the potential to sustain high levels of firm innovation capability. This study expects that employee willingness to both donate and collect knowledge with colleagues is likely to sustain innovativeness and thus better position the firm in terms of long-term competitive advantage. The following hypotheses thus are formulated:

- H6.* Employee willingness to donate knowledge positively influences firm innovation capability.
- H7.* Employee willingness to collect knowledge positively influences firm innovation capability.

Methods

Sample and data collection

A draft questionnaire was pilot tested by five MIS professors to ensure that the content and wording were free of problems. A total of 30 participants from ten organizations in five industries in Taiwan then examined the revised questionnaire. These participants were given the questionnaire and asked to examine it for meaningfulness, relevance, and clarity.

A total of 50 organizations were randomly selected from the top 1,000 firms list published by Common Wealth magazine in 2004, which listed the 1,000 largest firms in Taiwan. Ten survey packets were mailed to each of these 50 organizations in the summer of 2005. A cover letter explaining the study objectives and a stamped return envelope were enclosed. Follow-up letters also were sent about three weeks after the initial mailings. Of the 500 questionnaires distributed, 172 completed and usable questionnaires were returned, representing a response rate of 34.4 percent. Table I lists the respondent company characteristics, including industry type, gender, age, education level, working experience, and position.

Measures

In this study, items used to operationalize the constructs were mainly adapted from previous studies and modified for use in the knowledge-sharing context. All constructs were measured using multiple items. All items were measured using a seven-point Likert-type scale (ranging from 1 = strongly disagree to 7 = strongly agree). A list of items for each scale is presented in the appendix. The measurement approach for each theoretical construct in the model is described briefly below.

Enjoyment in helping others was measured using four items derived from Wasko and Faraj (2000), which focused on employee perceptions of pleasure obtained through sharing knowledge. A four-item scale measuring knowledge self-efficacy was adapted from a measure developed by Spreitzer (1995). It assesses employee judgments of their capability to share knowledge that is valuable to the organization. Top management support was measured using four items adapted from studies by Tan and Zhao (2003).

Demographic characteristics	Frequency		%
	No. of company	No. of response	
<i>Industry type</i>			
Manufacturing	13	51	29.7
Banking/insurance	6	27	15.7
Computers/communication	10	32	18.6
Transportation	4	17	9.9
Retail/wholesale	6	21	12.2
Real estate/construction	5	11	6.4
Health/foods	3	5	2.9
Utility	1	2	1.1
Others	2	6	3.5
<i>Gender</i>			
Male	126	73.3	
Female	46	26.7	
<i>Age</i>			
21-25	13	7.6	
26-30	70	40.7	
31-35	41	23.8	
36-40	24	13.9	
Over 40	21	12.2	
Missing	3	1.8	
<i>Education level</i>			
High school	11	6.4	
Bachelor	102	59.3	
Graduate	59	34.3	
<i>Working experience</i>			
0-3 years	18	10.5	
3-5 years	57	33.1	
5-10 years	43	25.0	
10-15 years	30	17.4	
Over 15 years	21	12.2	
Missing	3	1.8	
<i>Position</i>			
Director	13	7.6	
Manager	31	18.0	
Chief employee	72	41.8	
Employee	51	29.7	
Others	5	2.9	

Table I.
Profile of respondents
(*n* = 172)

These measurements assess the extent to which employees perceive support and encouragement of knowledge-sharing from top management. Organizational rewards were measured using four items derived from Hargadon (1998) and Davenport and Prusak (1998), which were defined as the extent to which employees believe that they will receive extrinsic incentives (such as salary, bonus, promotion, or job security) for sharing knowledge with colleagues. Additionally, ICT use was measured based on four

items taken from Lee and Choi (2003), which referred to the degree of technological usability and capability regarding knowledge sharing. Knowledge donating was measured using three items adapted from an investigation by Van den Hooff and Van Weenen (2004a), which assess the degree of employee willingness to contribute knowledge to colleagues. Knowledge collecting was measured using four items derived from Van den Hooff and Van Weenen (2004a), which referred to collective beliefs or behavioral routines related to the spread of learning among colleagues. Finally, firm innovation capability was measured using six items derived from Calantone *et al.* (2002), which focused on firm rate of innovation adoption.

Data analysis and results

Data analysis in this study was performed using structural equation modeling (SEM) to validate the research model. This approach was chosen because of its ability to test casual relationships between constructs with multiple measurement items (Joreskog and Sorbom, 1996). Numerous researchers have proposed a two-stage model-building process for applying SEM (Joreskog and Sorbom, 1996). The measurement model was first examined for instrument validation, followed by an analysis of the structural model for testing associations hypothesized in the research model. These results are described next.

Measurement model

The measurement model with all eight constructs was assessed using confirmatory factor analysis (CFA) (Anderson and Gerbing, 1992). The appendix presents factor loadings of indicators in the measurement model. All factor loadings exceed 0.5 and each indicator was significant at 0.01 levels. Moreover, from the appendix, the observed normed χ^2 for measurement model was 1.99 ($\chi^2/\text{df} = 1.99$; $\text{df} = 201$) which was smaller than 3 recommended by Bagozzi and Yi (1988). Other fit indexes included the goodness-of-fit index (GFI) and comparative fit index (CFI), they exceeded the recommended cut-off level of 0.9 (Bagozzi and Yi, 1988). The adjusted goodness-of-fit index (AGFI) also exceeded the recommended cut-off level of 0.8 (Chau and Hu, 2001). The root mean square error of approximation (RMSEA) was below the cut-off level of 0.08 recommended by Browne and Cudeck (1993). The combination of these results suggested that measurement model exhibited a good level of model fit.

The psychometric properties of eight constructs and indicators (dimensional scales) were assessed with respect to convergent validity and discriminant validity (Joreskog and Sorbom, 1996). The reliability of the constructs (composite reliability) and the average variance extracted were used as the measures for convergent validity (Fornell and Larcker, 1981; Bagozzi and Yi, 1988). From the appendix, the composite reliability of all constructs exceeded the benchmark of 0.7 recommended by Nunnally and Bernstein (1994). In terms of average variance extracted, all constructors exceed the suggested value of 0.5 (Bagozzi and Yi, 1988), indicating the measure has adequately convergent validity. Discriminant validity is demonstrated when the respective average variance extracted is larger than the squared correlation between two constructs (Fornell and Larcker, 1981). Table II shows the comparison between squared correlations of two constructs (off-diagonal elements) and the average variance extracted for each construct (diagonal elements). Overall, all of the eight constructs show evidence of high discriminant validity. In summary, the measurement

	1	2	3	4	5	6	7	8
1. Enjoyment in helping others	0.59*							
2. Knowledge self-efficacy	0.21	0.67*						
3. Top management support	0.32	0.37	0.51*					
4. Organizational rewards	0.24	0.31	0.19	0.58*				
5. ICT use	0.45	0.13	0.27	0.23	0.64*			
6. Knowledge donating	0.25	0.41	0.38	0.10	0.08	0.66*		
7. Knowledge collecting	0.32	0.21	0.31	0.26	0.37	0.50	0.61*	
8. Firm innovation capability	0.50	0.39	0.25	0.26	0.17	0.39	0.51	0.59*

Notes: *Diagonal elements are the average variance extracted for each of the eight constructs. Off-diagonal elements are the squared correlations between constructs. For discriminant validity, diagonal elements should be larger than off-diagonal; All of the correlations are significant at the $p < 0.01$ level

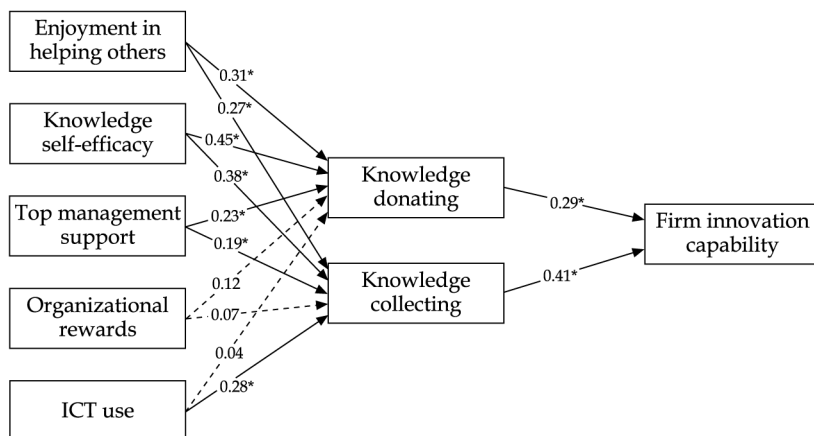
Table II.
Test of discriminant validity

model demonstrated adequate reliability, convergent validity and discriminant validity.

Structural model

The first step in model estimation was to examine the goodness-of-fit of the hypothesized model in Figure 3. The observed normed χ^2 was 2.24 ($\chi^2/df = 477.25/213$). The GFI is 0.88, AGFI is 0.84, NFI is 0.87, CFI is 0.92, and RMSEA is 0.06. The results of goodness-of-fit indices exhibited a moderate but acceptance level of overall model fit and, therefore, provided support to the overall validity of the structural model. The second step in model estimation was to examine the significance of each hypothesized path in the research model. The results of the analysis are depicted in Figure 3 (significant paths depicted by bold lines and insignificant paths by dash lines) and summarized in Table III.

In hypotheses *H1a*, *H1b*, *H2a*, and *H2b*, this study examined the effects of individual factors on knowledge sharing processes. The results found that both



Note: * $p < 0.01$

Figure 3.
Results of structural model

Hypothesis	Hypothesized path	Path coefficient	Results
<i>H1a</i>	Enjoyment in helping others → knowledge donating	0.31*	Supported
<i>H1b</i>	Enjoyment in helping others → knowledge collecting	0.27*	Supported
<i>H2a</i>	Knowledge self-efficacy → knowledge donating	0.45*	Supported
<i>H2b</i>	Knowledge self-efficacy → knowledge collecting	0.38*	Supported
<i>H3a</i>	Top management support → knowledge donating	0.23*	Supported
<i>H3b</i>	Top management support → knowledge collecting	0.19*	Supported
<i>H4a</i>	Organizational rewards → knowledge donating	0.12	Not supported
<i>H4b</i>	Organizational rewards → knowledge collecting	0.07	Not supported
<i>H5a</i>	ICT use → knowledge donating	0.04	Not supported
<i>H5b</i>	ICT use → knowledge collecting	0.28*	Supported
<i>H6</i>	Knowledge donating → Firm innovation capability	0.29*	Supported
<i>H7</i>	Knowledge collecting → Firm innovation capability	0.41*	Supported

Note: * $p < 0.01$

Table III.
Results of structural model

enjoyment in helping others and knowledge self-efficacy were found to positively influence knowledge donating and knowledge collecting. Furthermore, the top management support variable was found to be influential in knowledge sharing processes, supporting *H3a* and *H3b*. However, hypotheses *H4a* and *H4b* were not supported, the results show that organizational rewards had no significant relationship with employee willingness to donate and collect knowledge. Moreover, ICT use was found to positively influence knowledge collecting (*H5b*), but the linking ICT use and knowledge donating was not supported (*H5a*). Finally, the impact of firm innovation capability was found to be strongly positively associated with employee willingness to donate and collect knowledge, supporting hypotheses *H6* and *H7*.

Discussion and implications

This study is interesting from both theoretical and practical perspectives. Theoretically, this study proposed a research model for empirical studies to link knowledge sharing enablers and processes with firm innovation capability. The results from a structural equation modeling approach provide quite a strong support for the hypothesized relations. The results show that two individual factors (enjoyment in helping others and knowledge self-efficacy) and one of the organizational factor (top management support) significantly influence knowledge sharing processes. The results also indicate that employee willingness to both donate and collect knowledge enable the firm to improve innovation capability. From a practical perspective, the relationships among knowledge sharing enablers, processes, and firm innovation capability may provide a clue regarding how firms can promote knowledge sharing culture to sustain their innovation performance. Discussion of the findings, implications for practitioners and limitations and directions for future research are presented below.

Discussion of findings

First, the findings of this study indicate that both enjoyment in helping others and knowledge self-efficacy were strongly associated with employee willingness to share knowledge. This result implies that employees who feel pleasure in sharing knowledge and thus helping others tend to be more motivated to donate and collect knowledge with colleagues. Additionally, a sense of the competence and confidence of employees may be requirement for employees to engage in knowledge sharing. That is, employees who believe in their ability to share organizationally useful knowledge tend to have stronger motivation to share knowledge with their colleagues.

Related to organizational factors, top management support was effective for employee willingness to both donate and collect knowledge with colleagues, but organizational rewards was not. The findings indicate that perceptions of top management encouragement of knowledge sharing influence employee willingness to share knowledge. Therefore, management should recognize that organizational rewards only secure temporary compliance. To promote knowledge sharing activities, top management facilitation of social interaction culture is more important than extrinsically motivated employees (such as those motivated by monetary compensation).

Moreover, the results show a positive significant relationship between ICT use and knowledge collecting, but no significant relationship with knowledge donating. Although analytical results show that most respondents agreed that the use of various ICT tools help employees in receiving knowledge, the results reveal no significant relationship between ICT use and knowledge donating. This phenomenon may be explained by the fact that organizations exhibit a tendency for employees to use knowledge as their source of power for personal advantage rather than as an organizational resource (Syed-Ikhsan and Rowland, 2004). Knowledge thus cannot be distributed simply via online database or intranet. This finding might also be caused by the fact that investing in ICT alone is not enough to facilitate knowledge donating, because ICT can provide access to knowledge, but access is not the same as using or applying knowledge. That is, knowledge sharing involves social and human interaction, not simply ICT usage.

Finally, the results indicate that employee willingness to both donate and collect knowledge is significantly related to firm innovation capability. The findings suggest that innovation involves a broad process of knowledge sharing that enables the implementation of new ideas, processes, products, or services. As Jantunen (2005) noted, a positive knowledge sharing culture helps firms improve innovation capability. Therefore, the change introduced by the companies involves a broad incorporation of knowledge sharing mechanisms which attempt to foster innovation, such as the allocation of a budget for providing adequate training for knowledge transfer, the linking of staff-turnover to the generation of new ideas, or the creation of teams systematically devoted to new initiatives generation.

Implications for practitioners

This study proposes the following implications for helping managers establish a successful knowledge sharing strategy. First, the findings of this study confirm that individual factors are associated with knowledge sharing processes. Since enjoyment in helping others significantly influenced employee knowledge sharing behaviors,

managers need to increase the level of enjoyment that employees experience as they help one another through knowledge sharing. Managers interested in developing and sustaining knowledge sharing should focus on enhancing the positive mood state of employees regarding social exchange (i.e. enjoyment in helping others), which precedes knowledge sharing activities. Moreover, managers should pay more attention to provide useful feedback to improve employee knowledge self-efficacy. For instance, a highly self-efficacious staff can be established being by recruiting and selecting employees who are proactive, and who have high cognitive aptitude and self-esteem and are intrinsically motivated. Second, top management facilitation of knowledge sharing is important to enable a firm with superior competence in knowledge sharing to succeed in innovation performance. However, this study has verified that organizational rewards are not significantly related to knowledge sharing processes. Therefore, this study suggests that do not emphasize organizational rewards (such as salary incentive, bonuses, promotion incentive, or job security) as a primary knowledge sharing mechanism, because extrinsic rewards secure online temporary compliance (Kohn, 1993). This means that organizational rewards may provide temporary incentives for knowledge sharing, but is not fundamental force forming employee knowledge sharing behaviors. Finally, reliance on a techno-centric approach to knowledge sharing is insufficient for achieving the necessary social relationships and interpersonal interactions of employees for facilitating employee willingness to donate knowledge. Therefore, all transitional elements, such as organizational culture, top management support, ICT use, and human resources, should always be considered together when promoting knowledge sharing initiatives.

Limitations and directions for future research

Future studies should focus on five areas to overcome the limitations of the present study. First, previous research has suggested a significant relationship between individual differences and employee perceptions of knowledge sharing culture (Connelly and Kelloway, 2003). Future research can examine how personal traits (such as age, level of education, and working experiences) and organizational characteristics (such as firm size and industry type) may moderate the relationships between knowledge enablers and processes. Second, the significance of inter-organizational level in relation to knowledge sharing has not been considered. Future research could consider outer knowledge sharing to come from the stakeholders such as customers and suppliers, which represent valuable sources of intelligence and new ideas. Third, this study focused on empirical studies to link knowledge sharing enablers and processes with firm innovation capability. This study, however, did not consider all enablers that are critical for knowledge sharing. Van den Hooff and Van Weenen (2004a) proposed that communication climate and employee affective commitment are antecedents for knowledge sharing. Lee *et al.* (2006) verified empirically that dimensions of climate maturity (e.g. learning oriented, trust, and employee commitment) had an effect on the knowledge quality and level of knowledge sharing. Further research considering these factors could enhance an understanding of critical determinants for knowledge sharing. Fourth, the sample was drawn from 172 employees in 50 Taiwan organizations. Hence, the research model should be tested further using samples from other countries, since cultural differences among organizations influence employee perceptions regarding knowledge sharing, and

further testing thus would provide a more robust test of the hypotheses. Finally, an important focus for future research is the long-term effects (i.e. whether the factorable employees reactions were temporary or whether such reactions were sustainable) of motivation on employee knowledge sharing behaviors. Future studies can gather longitudinal data to examine the causality and interrelationships between variables that are important to knowledge sharing processes.

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Constructs	Indicators/Items	Factor loadings	Composite reliability	Average variance extracted
Enjoyment in helping others	I enjoy sharing my knowledge with colleagues	0.77	0.84	0.59
	I enjoy helping colleagues by sharing my knowledge	0.87		
	It feels good to help someone by sharing my knowledge	0.71		
	Sharing my knowledge with colleagues is pleasurable	0.84		
Knowledge self-efficacy	I am confident in my ability to provide knowledge that others in my company consider valuable	0.88	0.86	0.67
	I have the expertise required to provide valuable knowledge for my company	0.85		
	It does not really make any difference whether I share my knowledge with colleagues (reversed coded)	0.81		
	Most other employees can provide more valuable knowledge than I can (reversed coded)	0.85		
	Top management support	0.80		
Top managers always support and encourage employees to share their knowledge with colleagues	0.68			
Top managers provide most of the necessary help and resources to enable employees to share knowledge	0.73			
Top managers are keen to see that the employees are happy to share their knowledge with colleagues	0.67			
Organizational rewards	Sharing my knowledge with colleagues should be rewarded with a higher salary	0.70	0.75	0.58
	Sharing my knowledge with colleagues should be rewarded with a higher bonus	0.80		
	Sharing my knowledge with colleagues should be rewarded with a promotion	0.75		
	Sharing my knowledge with colleagues should be rewarded with an increased job security	0.84		
	ICT use	0.87		
Employees make extensive use of electronic storage (such as online databases and data warehousing) to access knowledge				

(continued)

Table AI.
Scale items and measurement model loadings

Constructs	Indicators/Items	Factor loadings	Composite reliability	Average variance extracted
Knowledge donating	Employees use knowledge networks (such as groupware, intranet, virtual communities, etc.) to communicate with colleagues	0.81	0.78	0.66
	My company uses technology that allows employees to share knowledge with other persons inside the organization	0.80		
	My company uses technology that allows employees to share knowledge with other persons outside the organization	0.75		
	When I have learned something new, I tell my colleagues about it	0.72		
Knowledge collecting	When they have learned something new, my colleagues tell me about it	0.81	0.80	0.61
	Knowledge sharing among colleagues is considered normal in my company	0.83		
	I share information I have with colleagues when they ask for it	0.75		
	I share my skills with colleagues when they ask for it	0.81		
Firm innovation capability	Colleagues in my company share knowledge with me when I ask them to	0.84	0.77	0.57
	Colleagues in my company share their skills with me when I ask them to	0.70		
	Our company frequently tries out new ideas	0.72		
	Our company seeks new ways of doing things	0.78		
	Our company is creative in its operating methods	0.82		
	Our company is frequently the first to market new products and services	0.75		
	Innovation is perceived as too risky in our company and is resisted (reversed coded)	0.81		
	Our new product introduction has increased during the last five years	0.77		

Notes: All *t*-values are significant at $p < 0.01$; Measurement model goodness-of-fit: $\chi^2/df = 417.6/201 = 1.99$; GFI = 0.90; AGFI = 0.85; NFI = 0.89; CFI = 0.94; RMSEA = 0.05

Table AI.

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Hsiu-Fen Lin is an Assistant Professor of Information Management in the Department of Shipping and Transportation Management, National Taiwan Ocean University. Her primary research interests include electronic commerce, knowledge management and organizational impact of information technology.

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